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**Proposed Wastewater Treatment Facilities
South Shore Lake Tahoe Basin
Draft Environmental Impact Statement**

South Tahoe Public Utilities District, South Lake Tahoe, CA

Prepared for

Environmental Protection Agency, San Francisco, CA Region IX

Oct 79



U.S. Environmental Protection Agency, Region IX
215 Fremont St. San Francisco, Ca. 94105

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DRAFT ENVIRONMENTAL IMPACT STATEMENT
PROPOSED WASTEWATER TREATMENT FACILITIES
SOUTH SHORE LAKE TAHOE BASIN

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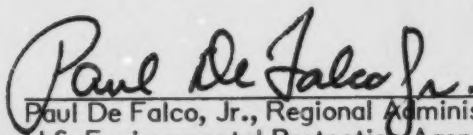
DRAFT ENVIRONMENTAL IMPACT STATEMENT

SOUTH TAHOE PUBLIC UTILITIES DISTRICT
AND
DOUGLAS COUNTY SEWER IMPROVEMENT DISTRICT NO. 1
PROPOSED WASTEWATER TREATMENT FACILITIES

El Dorado and Alpine Counties, California
and
Douglas County, Nevada

Lead Agency: U.S. Environmental Protection Agency

Responsible Official:


Paul De Falco, Jr., Regional Administrator
U.S. Environmental Protection Agency, Region IX
San Francisco, California

For Information Contact: Dave Jones, Janet Rosati, or Val Danos
U.S. Environmental Protection Agency, Region IX
215 Fremont Street
San Francisco, California 94105
(415) 556-2766, 556-8043, or 556-3040

Comments: Comments regarding this environmental impact statement should be sent to Janet Rosati (address above) by February 22, 1980.

ABSTRACT: This draft environmental impact statement investigates the secondary impacts of expanding and improving the two wastewater treatment facilities that serve the south shore of the Lake Tahoe Basin. The statement describes five alternative growth scenarios which are used to assess the impacts on both the natural and man-made (social) environments. The anticipated levels of development range from very limited to full buildout on the available land. A wide range of mitigation measures are also identified to minimize significant adverse environmental effects on growth. These effects include degradation of water quality, loss of environmentally sensitive lands, disturbance of fish and wildlife habitats, deterioration of air quality, and loss of visual resources.

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SUMMARY

WHAT IS THE PROBLEM?

The South Tahoe Public Utilities District (STPUD) and the Douglas County Sewer Improvement District No. 1 (DCSID) provide wastewater treatment to the south shore area of the Lake Tahoe Basin. Recently, they have had difficulties in plant operations and treatment reliability. These problems have resulted in violations of state and federal requirements for sewage and for the quality of the water into which the sewage is discharged.

For STPUD, occasional fish kills in Indian Creek Reservoir where the sewage is disposed have occurred. Also, leakages from the export pipelines have caused direct discharge of sewage into waters of the Lake Tahoe Basin. As a result of the problems and violations, the Lahontan Regional Water Quality Board issued a cease and desist order to the district in 1977. The order required plant modifications and imposed a limit on sewer connections until STPUD could demonstrate compliance with the waste discharge requirements.

For DCSID, effluent quality is unable to meet the existing effluent limitations. The need for plant improvements is critical now, because the state of Nevada has recently taken over the permit authority from the U.S. Environmental Protection Agency (EPA) and has proposed even more stringent effluent limitations. Presently, during the growing season, treated wastewater is used for irrigation. However, during the rest of the year, DCSID must discharge the effluent to the Carson River. Continued use of the river for disposal would require installation of advanced wastewater treatment process units to meet the more stringent effluent limitations.

WHAT IS THE SOLUTION?

To meet requirements for sewage quality and to meet the needs of anticipated growth, STPUD is planning to improve and expand its sewage treatment facilities and to change its sewage disposal site; DCSID is planning to upgrade its facilities and modify its sewage disposal method. To this end, they have undertaken planning programs and have applied to EPA for federal funds to help design and construct the new facilities.

WHAT HAS BEEN DONE?

Both of the districts have prepared "facilities plans" to define various means or alternatives for improving the treatment facilities. In addition, environmental assessments of these programs have examined the potential impacts on the air, water, land, and biological resources of the region. For STPUD this assessment was

prepared as an environmental impact report, under the California Environmental Quality Act of 1970. For DCSID, the assessment is contained in the facilities plan document. These reports are available at the offices of STPUD, DCSID, the Lahontan Regional Water Quality Control Board, and EPA, Region IX.

From among the alternatives examined, a recommended or preferred alternative was selected by each district on the basis of its ability to meet requirements efficiently at a reasonable cost and with the least adverse effect on the environment. STPUD's preferred alternative is to abandon its advanced sewage treatment process for a secondary one (that level required by the Federal Water Pollution Control Act Amendments of 1972); to expand its treatment capacity from 7.0 million gallons per day (mgd) to 10.0 mgd; and to dispose of the treated sewage by land application in Alpine County rather than into Indian Creek Reservoir. DCSID's preferred alternative is to improve its existing secondary treatment process; to discontinue discharge to the Carson River; to dispose of the treated sewage by land application in Carson Valley, Nevada during the growing season; and to store the sewage in reservoirs at other times. (However, the district is proposing to study the feasibility of land application during the non-growing season.) The DCSID draft facility plan does not request an expansion beyond the original design capacity of 3.0 mgd.

WHAT IS TREES?

Due to the controversy attached to various local, state, and federal actions in the Lake Tahoe Basin and concern over potential environmental degradation, a decision was made by EPA to prepare an environmental impact statement (EIS) for both districts pursuant to the National Environmental Policy Act.

An environmental impact statement analyzes the effects of preferred alternatives. There are two broad categories of effects. Direct effects (also known as primary impacts) result from the construction and operation of the project. They may include excavation and clearing of open space land, grazing land or other valuable land resources; loss of views from scenic highways; and increased levels of noise, dust, and traffic during the construction period. Indirect effects (secondary impacts) are the long term consequences of implementing the project. These effects may include consequences of the direct effects, population growth, changes in land use, and the effects of these changes in resources such as air and water quality and wildlife. The indirect effects of these proposed projects are far-reaching; they may permanently alter the character of the region.

The direct effects of the treatment plant improvements and expansion were treated in the environmental assessments on the facilities plans. However, these reports did not examine the indirect effects of the project. This, then, is the purpose of this EIS, also known as the Tahoe Region Environmental Evaluation Study (TREES): to document the indirect effects of expanding and improving the STPUD and DCSID wastewater treatment facilities. This analysis of the indirect effects, along with the other studies, will be used by EPA to decide to what extent the projects can be implemented without diminishing the environmental values of the Lake Tahoe Basin and the Upper Carson River Basin.

HOW WILL INCREASED TREATMENT CAPACITY AFFECT GROWTH?

The indirect effects of most concern to EPA are the consequences of increased development of the region. If the treatment facilities are expanded, higher levels of population and economic activity could be accommodated; without expansion, development of the area would be limited. Thus a decision on how much to expand the treatment capacity is necessarily a decision on how much growth will take place.

Where this growth could be accommodated is another issue. For example, a decision to expand the STPUD facilities would facilitate increased residential development on the California side of the south shore; a decision to expand the DCSID facilities would primarily allow increased casino development and, hence, more employment and visitors on the Nevada side. Therefore, if expansion of the STPUD facilities is limited and the DCSID facilities are permitted to expand, workers attracted by casino development, who might otherwise have been housed in the California south shore areas, would "spill over" into the nearby Upper Carson River Basin to find housing.

HOW DOES TREES ASSESS THE ENVIRONMENTAL CONSEQUENCES OF EXPANDED TREATMENT CAPACITY?

To assess the indirect effects of increased sewage treatment plant capacity on the environments of the Lake Tahoe and Upper Carson River basins, five sets of assumptions concerning future population growth were developed. Known as growth scenarios, they describe the way growth will occur. The levels of development described by the scenarios vary from very little to full buildout of available land (under current land use plans) in the south shore.

The population and urbanization levels of each of these growth scenarios are summarized, and the treatment capacity needed to serve each of the scenarios are shown on Table 1. A 10 million gallons per day (mgd) facility in STPUD would correspond to the growth level anticipated under either Scenario 2 or 5. The consequences of expanding capacity to 10 mgd can be seen by reviewing the impacts associated with Scenarios 2 and 5.

The description and analysis of impacts in TREES cover both the natural and man-made (social) environments of the Lake Tahoe and Upper Carson River basins. The natural environment includes land, water, air, biological, and visual resources. The social environment includes land use, housing, transportation, recreational facilities, public services, utilities, and cultural resources.

TABLE I
SUMMARY COMPARISON OF THE FIVE
ALTERNATIVE GROWTH SCENARIOS

	Study Area	Population Growth and Economic Development	Required ¹ Treatment Capacity (million gallons/day)	Activity Level Ranking ²
Scenario 1	South Shore: STPUD	Low	7.3	Lowest
	DCSID	Low	3.1	
	Upper Carson River Basin ³	Low	--	Low
Scenario 2	South Shore: STPUD	High	9.9	Low
	DCSID	Low	3.1	
	Upper Carson River Basin ³	Low	--	Lowest
Scenario 3	South Shore: STPUD	Medium	8.7	Medium
	DCSID	Medium	4.6	
	Upper Carson River Basin ³	Medium	--	Medium
Scenario 4	South Shore: STPUD	Low	7.2	High
	DCSID	High	6.6	
	Upper Carson River Basin ³	High	--	Highest
Scenario 5	South Shore: STPUD	High	10.0	Highest
	DSCID	High	6.3	
	Upper Carson River Basin ³	High	--	High

¹The required treatment capacity is the size needed to accommodate the expected maximum daily flows.

²The activity level is a composite index reflecting levels of resident population, overnight visitors, housing units, commercial floor space, and employment. The ranking places each scenarios on a scale of lowest to highest.

³The Upper Carson River Basin is east of the Lake Tahoe Basin. Both STPUD and DCSID dispose of their sewage in this area which includes the Carson Valley of Douglas County, Nevada and Alpine County, California.

WHAT ARE SOME OF THE INDIRECT EFFECTS IN THE LAKE TAHOE BASIN? ¹

Natural Environment

Water Quality. Water quality in Lake Tahoe and its tributaries is affected by land disturbance and vegetation removal, both of which would increase if urbanization in the basin continues. Although the waters of the lake are still of excellent quality, nutrients from surface runoff have stimulated algal growth, particularly in near-shore waters, and large amounts of soil (sediment plumes) have been detected at mouths of tributaries draining urban watersheds. The intensity and frequency of these problems have coincided with the rapid residential and commercial development of the basin over the past decade.

Deterioration of water quality can be directly related to the level of development that occurs in high erosion hazard lands and stream environment zones (SEZs). Land disturbance in high erosion hazards lands causes excessive amounts of soil loss which, if permitted in surface waters, would diminish their clarity, disturb fish and wildlife habitats, stimulate unsightly algal growths, and reduce the visual appearance of the natural environment. Construction activities, land disturbance, and vegetation removal in SEZ (those regions which surround a stream, which may be flooded by a stream, and in which actions of man may directly affect the stream) would reduce the effectiveness of these zones to convey spring snowmelt, stormwater, and other runoff from basin hillsides to the lake. More significantly, the capacity of these zones to provide natural treatment for runoff by filtering out and settling pollutants would be eliminated. The amount of vacant land presently in these environmentally sensitive areas is indicated in Table 2.

Development of these lands accelerates nutrient and sediment loadings which could increase algal growths by as much as 30 percent and reduce clarity by as much as 20 percent during spring conditions. These effects would be especially noticeable in the near-shore waters where they would interfere with beneficial uses of aesthetic enjoyment and water contact recreation.

Biology. Lands in SEZs are also valuable fish and wildlife habitats. Thus, construction activities that encroach upon these lands would also eliminate sensitive biological resources. Based on recent development trends, development of vacant SEZ lots in the STPUD service area would range from a low of 19 percent of total vacant SEZ lots under Scenarios 1 and 4 to a high of 100 percent under Scenarios 2 and 5. In the DCSID service area, construction of housing units in SEZs would range from a low of 12 percent of total housing units in SEZs under Scenarios 1 and 2 to a high of 100 percent under Scenarios 4 and 5. However, as noted in the later discussion on mitigation of adverse impacts, STPUD, DCSID, and local governments must assure EPA that future development does not result in degradation of tributary streams and near-shore waters. Therefore, the amount of growth which will be allowed to occur in SEZs may not follow past trends.

¹ The discussion here covers only the significant adverse effects. A complete discussion of impacts on both the natural and social environments is contained in the EIS.

TABLE 2
VACANT LAND IN LOW CAPABILITY LANDS¹

	High Erosion Hazard Lands		Stream Environment Zones			
	STPUD	DCSID	STPUD		DCSID	
	Acres	Acres	Acres	Lots	Acres	Lots
Residential	611	552	1,212		131	
Rural Estates				4		19
Low Density				2,815		81
Medium Density				620		3
High Density				188		27
Commercial						
Tourist	23	17	34	64	62	2
General	41	11	100	172	15	1
Public Service				7		1
Conservation Reserve				12		4
Recreation				8		5
General Forest				239		155
Total				4,129		298

¹ Acres of land in high erosion hazard lands or in SEZs were determined for residentially and commercially zoned lands only. The acreage figures represent the total amount of land in low capability lands. The amount of land in these areas actually available for development is less because of the lot coverage restrictions imposed by TRPA and CTRPA. Lots in SEZs were tabulated from data compiled by TRPA for its "208" Water Quality Management Plan.

Noise and Air Quality. Ambient noise levels would rise and air quality would deteriorate as the numbers of residents and visitors increase. Greater traffic volumes, particularly along Kingsbury Grade, would expose basin users to unacceptable noise levels. Existing traffic volumes already cause violations of the carbon monoxide (CO) air quality standard. Under all scenarios, traffic volumes in the south shore would result in more frequent violations of the CO standards; violations of as much as 65 percent above the standard are expected.

Visual Resources. Increased development would result in a worsening of visual problems. About 57 percent of the major traffic zones in DCSID and all of the major zones in STPUD in which development is anticipated are close to major roadways. Because development would occur first in areas near roadways, a relatively large number of view corridors would be removed even under low growth scenarios (Scenarios 1 and 4). Development of lots further from roads and infilling of already developed areas would occur in Scenarios 2, 3 and 5. Further development would gradually transform the character of the Lake Tahoe Basin from a natural to an urban environment in areas most accessible to visitors and residents.

Social Environment

Land Use. Changes in land use under the various scenarios are significant, as shown in Table 3. In general the smaller the percentage of land developed, the greater the flexibility in planning and coordinating the location and timing of growth to avoid conflicts between land use, environmental quality, and economic development. In the STPUD service area, Scenarios 1 and 4 provide the least change in land use and the highest degree of land use flexibility; Scenarios 2 and 5 provide the greatest change in land use and the lowest degree of flexibility. Because of the CTRPA 85 percent buildout rule in California (no further land may be subdivided until 85 percent of the lots existing on August 29, 1975 are built upon), Scenarios 2 and 5 would commit large areas of residential land to low density development. Most commercial land area is concentrated along Highway 50 and south of the intersection of Highways 50 and 89. Commercial development would increase in these areas. In the DCSID service area, Scenarios 1 and 2 would provide the least change in land use and the highest degree of flexibility. Scenarios 4 and 5 would provide the greatest change in land use and the lowest degree of flexibility.

TABLE 3
PERCENT OF VACANT LAND DEVELOPED

	1978	1	2	Growth Scenarios		5
				3	4	
STPUD						
Residential	57	68	100	83	68	100
General commercial	67	80	103	91	75	105
Tourist commercial	64	72	82	88	72	96
DCSID						
Residential	65	88	88	93	100	100
General commercial	21	36	30	56	100	100
Tourist commercial	37	54	54	86	100	100

¹ Percentages exceed 100 percent for general commercial because land is assumed to be rezoned from other uses in order to accommodate projected demand for general commercial land.

Housing. Because of the growth in south shore employment and the increasing numbers of retired households and second-home buyers, demand for housing in the south shore basin would be strong under all scenarios. Housing prices are likely to increase by at least the rate of inflation under all scenarios. The higher the price of housing, the more the ability to pay for housing becomes a determinant of who can live in the Lake Tahoe Basin. The imbalance between the cost of housing and the amount households can afford may have the following results:

- demand for housing may "spill over" into nearby areas, particularly in the Carson Valley areas of Douglas County

- some households may pay more than they can presently afford for housing (e.g., up to 25 to 30 percent of income)
- some households may have to accept available housing even if their needs and preferences are not fully met
- the incidence of overcrowding may increase
- to the extent that housing opportunities are limited to second-home buyers and retired households with the willingness and ability to compete for available units, other households in these consumer groups will be unable to obtain housing in the south shore area.

Transportation. Residential and commercial growth would bring more people to the basin, which would further increase the volume of traffic. Traffic generated by residential development can be expected to increase in almost direct proportion to the population increase. Congestion interferes with the operation of emergency vehicles and buses, reduces access to business and residential areas, diverts through traffic to local streets, contributes to air and noise pollution, and generally interferes with the appreciation of the environment by visitors and residents. Traffic conditions in the STPUD and DCSID areas are already now congested, and these conditions are expected to get worse under all scenarios. Any action causing even a small increase in existing traffic would have undesirable traffic impacts.

Recreation. Publicly owned recreational facilities would be inadequate to meet the needs of users anticipated under all scenarios. Visitor demand would require substantial increases in the capacity of privately owned recreational facilities. Although landowners, developers, and facility operators would benefit financially in the short-term, new privately owned facilities may have adverse effects on the aesthetic quality of the basin. Ultimately, recreational use may become so intense that the quality of the recreational experience would be dramatically degraded. Greater occupancy of recreational sites may mean greater noise, less solitude, and damage to sites themselves.

Public Services/Fiscal Concerns. Under all scenarios, demand for health services would exceed supply, and the resulting overcrowded conditions could reduce quality of care. Areas of concern are the shortage of acute-care beds, and the shortage of space to expand Barton Memorial Hospital. More intermediate and skilled nursing facilities and an in-patient mental health clinic are also needed.

Under Scenarios 2 and 5 for the Lake Tahoe Unified School District and under all scenarios for the Douglas County School District, enrollments would exceed capacity, and additional classrooms and staff would be required. As estimates do not consider distribution, capacity of individual schools may be exceeded even though enrollment growth estimated under a scenario may be less than the districtwide capacity. In both STPUD and DCSID, growth is likely to require additional personnel and equipment to maintain present levels of law enforcement services. Since the provision of adequate law enforcement services is currently constrained during peak visitor periods, this situation is likely to continue under all scenarios unless service characteristics are improved above existing levels. In both STPUD and DCSID, the higher growth scenarios may require increased equipment and personnel to maintain present levels of fire protection service. Where

facilities required to maintain existing levels of service are not provided, the probability of structural and personal damage from fire would increase, possibly resulting in poorer insurance ratings and higher premiums.

Fiscal differences among the scenarios can be evaluated in terms of which scenarios appear to be "better" and why such conclusions can be reached. A better scenario would have a greater ability to generate revenues to fund anticipated service costs. The preferred scenario from a fiscal perspective is one that: a) allows at least some growth to minimize the inefficient use of existing facilities and to prevent default on existing bonded indebtedness; b) directs growth to locations where excess capacities exist, at least to the greatest possible extent (available capacities for the many different services may not coincide); and c) directs proportionately more growth to Nevada than California because of more favorable taxation policies. For example, overall population growth is lowest under Scenario 1, so that existing unused capacity could be used without requiring costly new investment. Scenario 4 directs the greatest proportion of total south shore growth into Nevada which would result in a greater ability to generate per-unit sales tax and property tax revenues.

Utilities. Water supply in the basin is controlled by the California-Nevada Interstate Compact. Of the 23,000 acre-feet per year allocated to the California part of the basin, 12,000 acre-feet per year are available for users in the STPUD service area. Although water use in STPUD for 1978 was only 8,000 acre-feet per year, growth anticipated under the low growth scenarios would require over 80 percent of the allocation. If the occupancy rate in resident or seasonal homes increases or a trend toward greater water use begins, then even low growth levels may create a water shortage. Water use at the medium (Scenario 3) and high growth levels (Scenarios 2 and 5) would exceed compact allocations. In DCSID medium growth levels (Scenario 3) would require more than 50 percent of the 11,000 acre-feet allocated to the entire Nevada half of the basin. Under high growth levels (Scenarios 4 and 5) more than 80 percent of this allocation would be needed to meet water demand in DCSID. With rapid growth also occurring in the Incline Village area, it is unlikely that the 11,000 acre-feet allocation would be adequate.

Sewage treatment capacity in STPUD would have to be expanded under Scenarios 2, 3, and 5. With some modifications, existing facilities can accommodate growth levels of Scenarios 1 and 4. In DCSID, growth levels under Scenarios 3, 4, and 5 would require additional sewage treatment capacity. Existing capacity is barely adequate to serve growth levels under Scenarios 1 and 2. If sewage capacity is limited (under one of the lower growth scenarios), property owners who have vacant land but are unable to develop this property would lose their investment and potential to earn income. Under low or medium growth scenarios where development would be allowed on only some residential lots or land, land values may be higher than they might have been because fewer units are built and housing prices are consequently higher. Thus, landowners and investors who are allowed to build and owners of existing housing may benefit from increased values of existing property.

Continued residential and commercial development could also require expansion of the energy supply system. Although the electrical supply system has an installed capacity to accommodate the low growth projected under Scenario 1, the present

supply system, if measured by the utility company's standard margin of safety, is inadequate. Under all other scenarios, demand would exceed the installed capacity.

A single transmission line supplies natural gas to the city of South Lake Tahoe, and a branch of this line goes north through Stateline. Any failure in this system (such as breakdown at the pressure limiting station) would cause natural gas shortages or outages. Those customers whose service would be interrupted first include STPUD, schools, hospitals, hotel-casinos, and other large commercial businesses. Because the basin service area is at the end of the supply system, pressures in the pipelines are barely adequate to provide reliable service. High growth scenarios in the STPUD or DCSID service areas would create natural gas demands exceeding supply.

Cultural Resources. Adverse impacts from urbanization on archaeological or historical sites would be likely under scenarios which would lead to intensive development on undeveloped terrain in the following areas:

- Lake Tahoe shore, particularly where creeks and rivers enter the lake (Madden Creek to Meeks Creek on the west shore; Truckee River and Truckee Marsh on the south shore; Edgewood Creek and Incline Creek on the east shore)
- Truckee River Valley from the city of South Lake Tahoe to the southern extension of the study area
- Fallen Leaf Lake and adjacent drainage basins
- Cascade Lake and adjacent drainage basins
- Major and intermittent waterways and sloughs in Douglas County, particularly the branches and forks of the Carson River.

These areas would be subject to severe development pressure under Scenarios 2, 3, and 5.

WHAT ARE SOME OF THE INDIRECT EFFECTS IN THE UPPER CARSON BASIN?¹

Measurements and analysis of impacts in the Upper Carson River Basin reflect only those impact attributed to the spillover population from the Lake Tahoe Basin. The analysis does not include any impacts that may result from households coming from other areas such as Carson City or Reno.

Natural Environment

Geology. The Carson Valley is an active geological zone and subject to periodic earthquakes. Lands near major fault zones are publicly owned or are zones for low-density use, but high spillover population under Scenarios 4 and 5 may

¹The discussion here covers only significant adverse effects. A complete discussion of impacts on both the natural and social environments is contained in the EIS.

stimulate intense development in the Jacks Valley area where a significant fault runs north through the valley along the base of the Carson Range near Genoa.

Biology. Other impacts of urbanization of the Carson Valley and Alpine County include possible disturbance to areas of primary biological significance. Areas of primary biological significance include deer wintering areas and migratory corridors, California natural areas, a Nevada State Wildlife area, and locations of rare or otherwise important species. These areas cannot support development without some damage. Also considered of primary significance are critical nesting areas for Swainson's Hawk, wintering areas for bald eagles and gold eagles, and wildlife areas in the Carson Range (including areas above 7000 feet in elevation) that are critical habitat for furbearers. These large areas could accommodate limited development, such as recreational use or low-density residential development, with suitable environmental controls.

Water Resources. Flood caused by high groundwater conditions, a large drainage area, and an extensive floodplain have caused significant damage in the Carson Valley. The hazards of flood damage increase proportionately with the degree of development projected within the 100-year floodplain under each growth scenario.

Visual Resources. Visual resources would be adversely affected under high growth scenarios, and the degree of impact would increase with level of development. The impact of development on visual conditions would be especially apparent in the valley floor, since development here would be highly visible from all roadways. Development in Alpine County would have an adverse effect if it is visible from roadways or if new roadways are required to serve the development. Lands zoned for residential use (special districts or residential) lie along all roadway units in Alpine County. These units could undergo significant deterioration in quality at high levels of growth (Scenarios 4 and 5), especially if zoned lands are developed. Development of the valley's agricultural and undeveloped land, with a corresponding increase in roadway capacity to serve the additional population, would significantly change the visual character of the basin.

Social Environment

Impacts on the social environment stem from the influx of households from the Lake Tahoe Basin. Population increases from the Lake Tahoe Basin range from 22 percent to 164 percent of existing Upper Carson River Basin population. Alpine County is especially sensitive to spillover because any growth in population would represent a substantial burden on fiscal resources and public services.

Housing. Demand for housing is one of the most significant impacts created by spillover population. As in the Lake Tahoe Basin, housing price may become a determinant of who can live in the Carson Valley. With a strong second-home market and land use policies oriented to large-lot, low-density development, the Carson Valley may not be affordable for the spillover population (mostly young, low-income employees).

Public Services/Fiscal Concerns. The impact of accommodating the spillover population will be particularly noticeable in the delivery of public services. Under Scenarios 3, 4, and 5 (moderate and high spillover), the already great discrepancy between supply and demand for health care systems would increase. Overcrowding would reduce the quality of care. Expansion of services would require increased state and federal funding, which is often unpredictable.

The same scenarios would require additional classrooms and staff in schools. As the estimates of enrollment growth do not take into account the distribution of students within the school district, the capacities of particular schools may be exceeded even though the enrollment growth estimated under a scenario is less than the districtwide capacity.

The increase in spillover population would probably require additional personnel and equipment for law enforcement and fire protection if present levels of service are to be maintained. Upgraded service standards would require more personnel and facilities. Where facilities required to maintain existing quality of service are not provided, lower levels of law enforcement and fire protection services may result.

In the Douglas County portions of the basin, fiscal resources are likely to be available to meet service demands. A substantial revenue base from gaming activities is available to the county, and with population growth and increased gaming activity, this revenue base would increase. In Alpine County, new development on any scale would require more fiscal resources than the present tax base can provide. Much of the responsibility for the public service facilities could be shifted to the developer of new housing (and thus to the housing consumer). Requirements for service provision could affect housing prices and the scale, type, and timing of development.

Utilities. Depletion of the water supply would occur with any additional demand unless it involves a water rights transfer or a redistribution of current use patterns. Surface water supply is irregular in Carson Valley because water supplies depend on the winter snow pack in the Sierra Nevada, and the stream flows are frequently low during midsummer and winter months. Agricultural irrigation, which accounts for almost all current water use, is supported by diversions from Carson River and is seriously affected during low streamflow months. Appropriations for surface water rights have been discontinued in Carson Valley because of limitations of available supply.

Groundwater supplies are also limited. Available supply is 32,000 acre-feet, and present appropriations equal 37,000 acre-feet. However, because not all appropriations are pumped, actual use more nearly equals supply. The Nevada State Engineer has named the Carson Valley groundwater basin a "designated basin." This designation allows him to exercise greater authority over the appropriation of groundwater supplies. Individual wells on parcels one acre or smaller have been prohibited; all other applications are reviewed for their potential impact on groundwater supplies and many are denied.

The preferred wastewater treatment alternative by DCSID calls for discontinuing effluent disposal in the Carson River and implementing a land application system. The critical implications of switching to land application are reduced streamflow in the East Fork and runoff from irrigated lands. By eliminating the present discharge

at Muller Lane, DCSID will have reduced the annual average flow of the East Fork by 3 mgd which accounts for a large portion of the dry season flow. Consequently, the problems associated with diminished flow such as higher pollutant concentrations may occur more frequently. Furthermore, surface runoff from irrigated lands may be of a poorer quality than the effluent currently discharged to the river.

Cultural Resources. The Upper Carson River Basin has abundant known archaeological and historical sites, and further sites, particularly archaeological sites, are likely to be found. Thus, the potential is high for direct and indirect adverse impacts on cultural resources from land alteration associated with population growth.

HOW CAN THESE EFFECTS BE MINIMIZED?

Mitigation measures are actions to minimize the effect of an adverse impact. These actions apply only to problems resulting from implementation of a facility alternative; they cannot be used to correct existing problems. Adverse primary or secondary impacts resulting from expanding treatment capacity beyond the baseline capacity of 5.8 mgd for STPUD and 2.3 for DCSID (peak 1978 wastewater flows) are subject to mitigation.

For each problem identified in the impact assessment of this EIS, a number of mitigation measures have been defined where feasible and appropriate. Each measure is then discussed in terms of how effective it would be, what agencies would be responsible for its implementation, and when it should be undertaken. Examples of such measures for possible impacts on the basin's natural environment are shown in Table 4.

Several other studies are currently underway that will have significant implications for the type and choice of mitigation measures to be applied in the Lake Tahoe Basin. The first study is the Nonattainment Plan that is being prepared to eliminate violations of the national ambient air quality standards of ozone and carbon monoxide. Corrective measures being proposed in that plan are aimed primarily at affecting transportation, land use and planning and stationary sources of air pollutants. The second study is the California State Water Resources Control Board's Water Quality Management Plan for the California side of the basin. Mitigation measures described in that document may address problems of erosion and eutrophication and prescribe restrictions on development in high erosion hazard lands and stream environment zones. To the extent possible, the mitigation measures to reduce adverse environmental consequences of the STPUD and DCSID facilities plans should be consistent and compatible with those identified in the other studies.

WHERE DO WE GO FROM HERE?

At this point, EPA has reviewed the studies that have been undertaken to resolve the problems confronting STPUD and DCSID. The agency recommends that the modifications to the sewage treatment processes described in the preferred alternatives for each of the two districts be undertaken. For STPUD, this means

improving certain processes of the existing plant and abandoning most of the advanced wastewater treatment facilities. The facility plan proposed disposal of secondary effluent by land application in Alpine County, California; however, the County has indicated some reluctance to irrigate with secondary effluent. Until this issue is resolved, EPA can only recommend that land application of the treated sewage be undertaken; recommendation of an effluent disposal must await the negotiations among STPUD, Alpine County, and Douglas County. Once these negotiations, which are presently in process, are complete and a site is selected, EPA will examine the environmental consequences and make a recommendation.

For DCSID, this means improving the existing secondary treatment plant, discontinuing discharge of effluent to the Carson River, land application of wastewater during the growing season, and storage of wastewater when it cannot be applied to the land. The DCSID facility plan recommended disposal of effluent on land owned by DCSID, but subsequent to the submittal of the document, DCSID negotiated a long-term contract with a Carson Valley rancher to accept summer flows. The district is also proposing to study the feasibility of land application during non-growing seasons. EPA's preferred alternative reflects this modification to the district's preferred alternative and encourages continued disposal on land owned by farmers and ranchers or on land controlled by the district.

STPUD is also seeking federal funds to expand its present treatment capacity to 10 mgd. EPA's position on this issue depends on the mitigation measures for which the district can obtain commitments. This EIS describes a number of different approaches to minimize significant adverse environmental effects. It is STPUD's responsibility to obtain commitments from various local, state, and federal agencies with authority to implement the mitigation measures and to demonstrate to EPA that there will be no deterioration of environmental quality. Accordingly, the next step between now and preparation of the final EIS is for STPUD to seek these commitments from implementing agencies. The result of this step will determine whether the project can be funded by 10 mgd as proposed by the district.

Similarly, DCSID must obtain commitments to minimize impacts of upgrading its plant to its original design capacity. Commitments to protect high erosion hazard lands, SEZs, and biological resources would be especially important for DCSID if it is to have its preferred alternative funded as proposed.

TABLE 4

MITIGATION MEASURES FOR ADVERSE
IMPACTS ON NATURAL RESOURCES

IMPACT AREA	MITIGATION MEASURE	RESPONSIBLE AGENCIES
Water Quality	Protect stream environment zones	TRPA, CTRPA, U.S. Forest Service
	Employ best management practices to control erosion (slope stabilization, revegetation, roadside and storm drainage, on-site infiltration, etc.)	Local governments, TRPA, CTRPA, Lahontan RWQCB, California SWRCB, Nevada DEP, U.S. Forest Service
	Institute evaluative point system and limit on number of sewer connections to control location and level of growth.	Local governments, TRPA, CTRPA
	Implement water quality monitoring program.	Lahontan RWQCB, California SWRCB, California Department of Water Resources, Nevada DEP, Nevada Environmental Commission, EPA, U.S. Forest Service, U.S. Geological Survey, U.C. Davis
	Purchase lots in environmentally sensitive areas.	Local governments, TRPA, CTRPA
	Compensate landowners who experience loss because of development restrictions.	(Would probably be determined by the courts)
	Implement system to transfer development rights to compensate owners for loss of land and to preserve critical areas.	Local governments, TRPA, CTRPA, EPA
Seismic Safety	Implement land use controls to control location of development.	Local governments, TRPA, CTRPA

TABLE 4 (Continued)

IMPACT AREA	MITIGATION MEASURE	RESPONSIBLE AGENCIES
Biological Resources	Control recreational use of habitats frequented by valuable fish and wildlife species.	TRPA, California and Nevada Departments of Fish and Game, U.S. Forest Service
	Protect active osprey nests.	Local governments, TRPA, California and Nevada Departments of Fish and Game, U.S. Forest Service
	Require biological inventories for rare and endangered species as part of development application.	TRPA, California Department of Fish and Game, U.S. Forest Service, U.S. Bureau of Land Management.
	Require adequate construction and management practices to protect vegetation and habitat.	TRPA, U.S. Forest Service
	Protect stream environment zones and implement erosion control standards.	(See "Water Quality")
Noise	Implement noise control ordinance.	Local governments, TRPA, CTRPA
	Revise zoning ordinance to prevent incompatible land uses.	Local governments, TRPA, CTRPA
	Establish special permit procedures to implement noise reduction measures.	Developers, local government, TRPA, CTRPA
	Construct noise barriers along major highways.	Local governments
Air Quality	Implement measures adopted in the approved Nonattainment Plan.	Local governments, TRPA, CTRPA, others identified in the Nonattainment Plan
Visual Resources	Implement measures protection of water and air quality.	(See "Water Quality" and "Air Quality")
	Adopt design plan with implementing ordinances for design review.	Local governments, TRPA, CTRPA, U.S. Forest Service
	Establish National Scenic Area.	U.S. Forest Service, U.S. Congress

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I. INTRODUCTION

A. TYPE OF ACTION

The South Tahoe Public Utilities District (STPUD) serves the California portion of the south shore area of the Lake Tahoe Basin from Emerald Bay in the west to the state line in the east. The present tertiary treatment facility was constructed in 1968 with a design capacity of 7.5 million gallons per day (mgd). STPUD had a consulting panel of engineers review the operation of the facility to determine its effective treatment capacity in 1978. The panel concluded that the components of the treatment process could operate at original design capacity, but effective capacity is only 7.0 mgd because of the limitations of an emergency storage pump. Effluent from the plant is exported out of the basin over Luther Pass to Indian Creek Reservoir in Alpine County (in the Upper River Basin) where it is used for recreational and irrigational purposes. The treatment plant intermittently violated waste discharge requirements from 1976 to 1977. Consequently, the Lahontan Regional Water Quality Control Board (RWQCB) issued a cease and desist order to the district in June 1977. The district is also restricted by Lahontan RWQCB in the number of new sewer hook-ups it can make each year, until it can demonstrate that effluent quality will consistently meet waste discharge requirements and receiving water quality standards. To meet waste discharge requirements, the district undertook a facilities planning program, which will require federal funds to implement.

The Douglas County Sewer Improvement District No. 1 (DCSID) serves the Nevada portion of the south shore area. The existing 3.0 mgd secondary treatment plant was constructed in 1968. Effluent from the plant is first pumped to an on-site holding reservoir and then over Daggett Pass for discharge in the East Fork Carson River (in the Upper Carson River Basin) during the winter and for agricultural irrigation during the growing season. Discharge requirements of the National Pollution Elimination Discharge System (NPDES) permit for biological oxygen demand and for suspended solids have been frequently violated since January 1976. Consequently, DCSID has also initiated a facilities planning program which will call for federal investment to implement.

B. NEED FOR EIS

The National Environmental Policy Act requires an environmental analysis of federally funded construction grant projects. The decision by the U.S. Environmental Protection Agency (EPA) to do an environmental impact statement (EIS) was based on the potential for environmental degradation and on the controversy attached to various local, state, and federal actions in the Lake Tahoe Basin. This EIS is intended primarily to document the indirect effects of expanding the STPUD and DCSID sewage treatment facilities. The direct effects have been adequately covered in the facilities plans and companion environmental impact reports, but those documents were unable to adequately examine the secondary impacts

resulting from continued urbanization in the basin and from pressures to develop areas outside of the basin by those seeking less expensive housing. Analyses completed during the EIS preparation will allow for the selection of the project alternative most suited to protection of the environmental values of the Lake Tahoe Basin and the Upper Carson River Basin.

C. ENVIRONMENTAL GOALS

Lake Tahoe and surrounding basin areas are renowned for their unique visual and recreational resources. It is toward the goals of protecting the region's natural attributes and ensuring that the man-made environment is compatible with these resources that this EIS is directed. The underlying question throughout the analysis has been what level of development can be accommodated by the natural ecosystem and by man's social environment without significant environmental consequences. Specific environmental goals identified as being of paramount significance include:

- water resources and quality: preservation of the lake and its tributaries in a manner consistent with the beneficial uses and the water quality objectives defined in the basin plans and with other objectives and policies of local, regional, state, and federal agencies.
- geology and soils: preservation of erodible soils and landforms
- biology: preservation of unique and sensitive vegetational communities and wildlife habitats, and the protection of threatened, rare, and endangered species
- noise: preservation of the ambient noise level
- air quality: preservation of the area's visual and biological resources in a manner consistent with the ambient air quality standards prescribed by the states and federal government
- visual resources: preservation of the unique natural features that make the region a scenic and recreational resource of national significance.

Goals for aspects of the social/cultural environment include preserving future land use options; providing a mix of housing choices; and preventing an increase in traffic congestion, an inadequate supply of recreational facilities, a lower quality of public service, a shortage of electricity and natural gas, and a loss of historic and archaeological resources.

II. ALTERNATIVES

A. ALTERNATIVE GROWTH SCENARIOS

I. NEED FOR GROWTH SCENARIOS

The South Tahoe Public Utilities District (STPUD) and the Douglas County Sewer Improvement District No. 1 (DCSID) are seeking to improve and expand their present wastewater treatment facilities. The level of treatment capacity is closely linked to the level of growth that could be accommodated in the region. If approval and funding for the expansions are granted, the treatment facilities could accommodate higher levels of population and economic activity than are now served. Without such expansion, the growth of the area would be constrained.

Increased capacity of the two treatment facilities would affect levels and distribution of population and economic activity in the south shore area and in the Upper Carson River Basin. Expansion of the STPUD facilities would primarily allow for residential development on the California side of the south shore. Expansion of the DCSID facilities would primarily allow for increased casino activity--that is, more employment and visitors. Decisions to expand either or both of the facilities will affect not only the immediate south shore area but also the adjacent Upper Carson River Basin. For instance, expansion of the DCSID facility will attract job seekers to the basin; yet, if the STPUD facility is not expanded, there will be insufficient sewage capacity for new dwelling units to house the workers. Consequently, they will "spill over" into the Upper Carson River Basin to find housing.

The growth scenarios described in the following sections are sets of assumptions concerning various levels of population and economic activity. Scenarios will be used in the following chapter to assess the impacts of growth on the natural and social environment of the area.

2. APPROACH TO DEFINING SCENARIOS

RECENT GROWTH TRENDS

Growth of an area results from the interplay of supply and demand forces. On the supply side, the Lake Tahoe Basin has unique natural beauty, large-scale recreational potential, and the availability of gaming on the Nevada side. The basin's proximity to metropolitan centers has permitted its development as an important weekend and vacation destination.

On the demand side, a rise in population and income, changing household composition, and increasing interest in outdoor recreation and casino activities have resulted in a large, year-round inflow of visitors. Increased gaming and

recreational patronage of the area have resulted in a demand for visitor accommodations and other commercial services. Moreover, the basin has attracted many people seeking second homes, which has induced additional commercial development.

Interaction of these supply and demand forces has resulted in growth of resort communities around the lake. Public land use policies and policies affecting the availability of infrastructure and other public services will affect the level and distribution of growth in the future.

South Shore Area (Lake Tahoe Basin)

The south shore's extensive development is in large part the consequence of the growth of casinos and of other businesses and hotels serving casino patrons. Employment in casinos has far exceeded the jobs provided by other recreational facilities. The casinos provide a second source of employment growth in that they attract visitors who need accommodations--restaurants, shopping facilities, and gas stations. A third layer of employment then results for the provision of service facilities to fill the needs of the employed.

Housing demand in the south shore is thus made up of employees of the casinos, second-home buyers, and retired persons. The availability of housing for these groups has had a major influence on the socio-economic characteristics of the south shore population and on the distribution of population growth. Demand for second homes for vacation and retirement has been a major impetus to growth of the area.

Recently, the supply of housing has lagged behind demand so that stiff competition for available units has resulted. Production of new units has been influenced by actual and expected changes in public land use policy, by the recent moratoria on new development, and by increases in the costs of new construction. As housing prices have increased, the ability of households to secure housing in south shore has largely depended on their ability and willingness to pay for it.

Many of those employed in jobs servicing visitors and residents of the area have had to pay increasing shares of their income for housing, and others have had to look for housing outside of the basin. The increasing importance of this spillover of residential demand makes it important for future assessments of the growth of the basin to include consideration of nearby areas, primarily those in the Upper Carson River Basin.

Carson Valley: Douglas County (Upper Carson River Basin)

The Carson Valley of Douglas County, Nevada, has been changing from a rural, agricultural community to a more economically diversified and increasingly residential area. The growth of employment opportunities in the south shore area, in Carson City, and, more recently, in Reno and the shortages of housing in these three areas have put pressure on Carson Valley to develop as a bedroom community. Such trends are expected to continue and to stimulate continued residential construction and associated population growth. In addition, Carson Valley is seen as a desirable location by many retired couples because of its mild climate, pastoral setting, and relatively low taxes. New employment opportunities

in construction, trade, services, and local government have emerged and serve as an additional stimulus to growth. Light industrial activities in the Minden-Gardnerville area have also created a number of jobs.

Carson Valley housing prices have also been rising. Prices are still below levels for somewhat comparable units in the basin or in the Carson City and Reno areas. Thus, demand pressure from all of these areas is likely to remain strong. The extent to which the supply of new units is able to expand will be a factor in determining how many and which types of households become residents of Carson Valley.

Alpine County (Upper Carson River Basin)

The growth of Alpine County, California, has been slow, primarily because much of the county is rugged wilderness area that is federally owned and because it is not conveniently accessible to nearby activity centers. A ski resort, logging and agricultural activities, and both short-term and second-home recreational uses support a small amount of employment. The county's greatest potential for growth is its recreational opportunities, which may attract more and more visitors and second-home owners.

In large part, growth will depend upon the county's policies toward new development and on the housing market situations in the south shore area and in the Carson Valley portion of Douglas County. Severe constraints on residential development in these areas will increase growth pressures in Alpine County.

KEY ASSUMPTIONS

The growth scenarios were based upon an understanding of the growth process in south shore and in nearby areas. They were defined so that they:

- can be related to capacity alternatives for wastewater treatment plants
- include consideration of all areas where growth could be affected by capacity decisions for STPUD and DCSID facilities
- reflect the influence of major factors affecting growth, particularly those sensitive to public policy decisions
- include a reasonable range of alternative scenarios given uncertainties regarding factors affecting growth
- describe realistic futures for the study areas considering private market activity within the context of public policies and regulations.

Growth scenarios were developed by combining assumptions concerning: a) levels of south shore growth, b) distributions of growth between STPUD and DCSID areas, and c) potential levels of spillover of residential demand and commercial activity to areas outside south shore. Given the assumptions described in Table 5, the major differences among scenarios result from assumptions made about the level of

Table 5

ASSUMPTIONS REGARDING MAJOR FACTORS
AFFECTING GROWTH IN STPD AND DCSID

FACTORS	ASSUMPTIONS MADE FOR THE PURPOSE OF DEFINING GROWTH SCENARIOS	REASONS FOR ASSUMPTIONS	COMMENTS REGARDING ASSUMPTIONS
CASINO DEVELOPMENT	The scenarios reflect three levels of casino expansion: - Low: No expansion of gaming floor space over 1978 levels; small increase in gaming activity as recent additions become more fully used. - Medium: Increase in gaming floor space or equivalent activity of 50,000 square feet (about 25% increase). - High: Increase in gaming floor space or equivalent activity of 110,000 square feet (about 60% increase).	- No single level of gaming activity can be assumed. Policies regarding expansion of gaming floor space are presently being considered. - Level of gaming activity affects employment and visitor levels, whether through expansion of activity in existing casinos or construction of new casinos.	High activity level chosen to correspond to existing casinos including Park Tahoe plus additional equivalent to planned or approved development (Harvey's expansion, Hotel Oliver, and Tahoe Palace). Medium level is an approximate mid-point.
HOUSING DEMAND OF PERSONS NOT EMPLOYED IN SOUTH SHORE	This demand (for second homes and retirement housing, primarily) is strong.	Historical trends, interviews with knowledgeable persons, and observations of market activity indicate a strong demand.	This demand may be influenced by other growth affecting factors and their effect on the attractiveness of the area. Definitive assumptions cannot be made, although the growth scenarios are sensitive to such variations.
U.S. FOREST SERVICE FACILITIES FOR NON-GAMING RECREATION	The "Fair Share" plan preferred alternative for expansion of facilities is assumed. The additions likely by the EIS horizon year 2000 are included in all scenarios.	This represented the most likely course of events at the time the scenarios were developed although the preferred alternative had not been adopted.	It is recognized that buildout on national forest land includes expansion beyond year 2000 given assumptions regarding reserve wastewater treatment capacity.
INFRASTRUCTURE AND PUBLIC SERVICES (EXCLUDING WASTEWATER TREATMENT FACILITIES)	- Necessary roads, schools, police and fire protection, etc. will either be expanded as growth occurs or are sufficient to permit growth. - Water supply is essential to growth; yet the extent to which water supply may be limited is not certain.	- Until growth projections are completed, the public service burden cannot be determined. Management of growth is better seen as a matter of public policy; supply of public services should then be consistent with those policies. - Resolution of interstate water compact is still being negotiated; and the California Water Resources Control Board is currently conducting a study of water supply in the Tahoe Basin. Preliminary findings indicate that water supply may be limited.	Need and ability to provide expanded infrastructure and additional public services addressed in impact assessment.

Continued

Table 5 Contd.

FACTORS	ASSUMPTIONS MADE FOR THE PURPOSE OF DEFINING GROWTH SCENARIOS	REASONS FOR ASSUMPTIONS	COMMENTS REGARDING ASSUMPTIONS
LAND USE POLICIES	1. TRPA policies in DCSID areas; CTRPA policies in STPUD areas and assuming no new subdivision approval. 2. The scenarios reflect alternative levels of residential development given these policies. Alternative levels chosen for evaluation include: STPUD DCSID Low Development of 2,072 vacant, subdivided lots. Development of 1,667 housing units. Medium Development of 6,036 vacant, subdivided lots. Development of 4,950 housing units. High Buildout of 10,000 vacant, subdivided lots. Buildout of all vacant, subdivided lots and all vacant land zoned for residential use under TRPA policies, allowing development of 0,233 housing units.	1. Present TRPA and CTRPA policies reflect the law. 2. It is recognized that: - Present land use plans and ordinances are in the process of being re-evaluated and updated; - Present CTRPA policies allow for new subdivisions after 85% of existing lots are built but do not guarantee new subdivision approval; and - All land zoned and/or subdivided may not be developed up to maximum density allowed. For the purposes of this analysis alternative levels of development are assumed because of uncertainty regarding future land use policies and of the need to consider different levels of development as basis for evaluating alternative wastewater treatment capacities.	Present TRPA policies in California would allow more development than CTRPA policies. Effects of this change evaluated qualitatively. High levels represent buildout under present TRPA and CTRPA land use policies. The low and medium levels are somewhat arbitrary; low levels allowing for approved development not yet built in summer 1978 plus some additional development (so that wastewater treatment capacity for one scenario would approximate the rated plant capacity for STPUD facilities), and medium levels representing a mid-point.
ENVIRONMENTAL STANDARDS	Growth is not directly constrained by environmental standards. Concern for the environment is reflected in other assumptions, especially in policies regarding land use and casino development.	1. No specific measures (other than land use policies) to meet regional environmental standards have been adopted. Uncertain at this stage which measures would be effective, which would be chosen, and which would be approved and enforced. 2. Impact analysis will be the basis for determining measures and enforcement policy.	It is recognized that environmental standards may affect or constrain growth; the effect of mitigation measures on growth can be addressed.

Continued

Table 5 Contd.

FACTORS	ASSUMPTIONS MADE FOR THE PURPOSE OF DEFINING GROWTH SCENARIOS	REASONS FOR ASSUMPTIONS	COMMENTS REGARDING ASSUMPTIONS
PUBLIC LAND ACQUISITION	1. Land covered by present U. S. Forest Service acquisition plans is excluded from land potentially available for development. 2. No other large scale public acquisition programs are assumed.	1. Except for possible purchase of two casino sites, there is presently no specific enacting legislation and accompanying appropriation level for significant land purchase. The Tahoe conservancy was passed in California but no funding has been appropriated. 2. Since proposals for a National Recreation Area (NRA), state purchase, or other large scale land purchase scheme are uncertain and somewhat undefined, it is not possible to define alternatives for the growth scenarios.	The effect of large scale land purchase on the level of growth in south shore can be evaluated as a variation of the lower growth scenarios.
WASTEWATER TREATMENT CAPACITIES	1. 1978 maximum day flows as baseline measurements; 5.8 mgd for STPUD and 2.3 mgd for DCSID #1. 2. Scenarios reflect probable futures requiring a range of capacities for STPUD and DCSID. 3. Full reserve capacity committed by contract for the U. S. Forest Service held for their use under all scenarios even if not fully used by EIS horizon year 2000.	Participants agreed that capacity alternatives should not be inputs to scenario development; rather that scenarios, as reflections of probable futures, will be the basis for estimating required capacities.	

TABLE 6

SUMMARY FRAMEWORK FOR COMBINING ASSUMPTIONS
TO DEVELOP GROWTH SCENARIOS

		DCSID			
		1978	2000		
		190,000 sq. ft. gaming 2,985 housing units	No new gaming 1,667 new housing units (56% increase)	50,000 sq. ft. of new gaming (25% increase) 4,950 new housing units (166% increase)	110,000 sq. ft. of new gaming (60% increase) 8,233 new housing units (276% increase)
STPUD	1978	16,583 housing units	Existing		
	2000	2,072 new housing units (12% increase)		Scenario 1	Scenario 4
		6,036 new housing units (36% increase)		Scenario 3	
		10,000 new housing units (60% increase)		Scenario 2	Scenario 5

economic growth (related primarily to the amount of housing developed). Table 6 shows how the assumptions were combined to make up the five growth scenarios.

Spillover results from the combination of south shore employment and population growth. It is primarily determined by the number of casino and service sector employees unable to find housing in south shore. Other factors will also have a significant effect on growth in the Carson Valley: a) the probable outcome of the many factors influencing spillover from Carson City and Reno; b) the nature of other demands for locations in this valley; and c) the public policy responses to growth pressures from all of these sources. Consideration of these factors is outside the scope of this EIS.

3. DESCRIPTION OF GROWTH SCENARIOS

SUMMARY OF GROWTH SCENARIOS

The five growth scenarios estimate increases in population (residents, overnight visitors, and day visitors), employment, housing units, campsites, hotel/motel rooms, commercial floor space, and gaming floor space for the STPUD and DCSID service areas (the south shore at the Lake Tahoe Basin). Table 7 presents the totals for each of these elements for the 1978 baseline conditions and for the five growth scenarios for the year 2000, the planning horizon for this EIS.

Growth is defined as additions to baseline conditions in summer 1978. Baseline conditions include activity and population contributing to peak 1978 summer wastewater flows (5.8 mgd for STPUD and 2.3 mgd for DCSID). Development approved but not completed or occupied by summer 1978 is included.

Population growth for the south shore area described by the scenarios ranges from a 25 to 30 percent increase (Scenario 1) to a doubling of baseline conditions (Scenario 5). The points at which these growth levels would be reached vary with the scenario. The lowest level of growth, characterized by Scenario 1, would occur before the year 2000, and little growth is expected after the mid-1980s or early 1990s. Scenarios 2 through 4 describe growth levels likely to be reached between the years 1990 and 2000 (years vary between STPUD and DCSID depending upon distribution of growth). The highest growth level, Scenario 5, would occur by the year 2000.

As contracted reserve treatment capacity for the U.S. Forest Service is not likely to be fully used by 2000, some development and visitor population in addition to that defined by the scenarios would occur as a result of buildout under current plans for National Forest Service land. (Forest Service buildout would assume an increase over 1978 of 1,000 campsites, while the scenarios include the increase of 515 campsites by year 2000.)

Additional Forest Service development after year 2000 would add 3,000 more people to the peak day population totals shown in Table 7 or a 1.0 (Scenario 5) to 1.5 (Scenario 1) percent increase over peak day population totals for year 2000. Since this addition occurs in STPUD, it could increase population totals there by a slightly greater percentage.

TABLE 7
SUMMARY OF GROWTH SCENARIOS¹

	1978	1	2	3	4	5
Casino Activity (square feet)						
DCSID	190,000	190,000	190,000	240,000	300,000	300,000
Employment (jobs)						
Total	21,620	25,040	27,530	31,240	35,840	38,000
Commercial Floor Space (million square feet)						
STPUD	3.7	4.4	5.7	5.1	4.1	5.8
DCSID	0.7	1.3	1.1	1.9	3.3	2.7
Total	4.4	5.7	6.8	7.0	7.4	8.5
Hotel/Motel Rooms						
STPUD	7,450	8,450	9,570	10,330	8,450	11,250
DCSID	2,210	3,210	3,210	5,090	10,160	7,360
Total	9,660	11,660	12,780	15,420	18,610	18,610
Campsites						
STPUD	1,225	1,772	1,973	1,973	1,973	1,973
DCSID	440	668	767	767	767	767
Total	1,625	2,440	2,740	2,740	2,740	2,740
Housing Units						
STPUD	16,583	18,655	26,583	22,619	18,655	26,583
DCSID	2,985	4,652	4,652	7,935	11,218	11,218
Total	19,568	23,307	31,235	30,554	29,873	37,801
Residents ²						
STPUD	27,780	30,220	37,820	35,170	29,780	40,510
DCSID	7,070	9,060	9,740	16,110	19,760	18,760
Total	34,850	39,280	47,560	51,280	49,540	59,270
Overnight Visitors ²						
STPUD	63,300	73,670	102,510	90,330	74,600	103,190
DCSID	12,290	20,610	20,610	33,640	57,590	49,710
Total	75,590	94,280	123,120	123,970	132,190	152,900
Day Visitors ²						
Total	55,180	72,950	89,870	90,500	96,490	111,620
Peak Day Population	165,620	206,510	260,550	265,750	278,220	323,790
Average Summer Population	118,250	150,740	192,380	195,890	208,190	240,800
Annual Visitor Days (millions)	20.6	26.7	34.0	34.6	38.6	43.3

¹Total, Year 2000. Growth equals difference between scenario and 1978 totals.

²Peak Day Totals

TABLE 8
SUMMARY OF SPILLOVER FOR GROWTH SCENARIOS

	1	2	Growth Scenarios		5
			3	4	
Spillover population (percent increase of 1978 population)	33	27	55	164	146
New residents	4,270	3,450	7,200	21,370	18,980
New housing units	1,340	1,080	2,250	6,680	5,930
New service employment	380	310	640	1,900	1,690

Note: These figures only reflect growth that cannot be accommodated in the Lake Tahoe Basin and do not reflect other sources of population growth in the Upper Carson River Basin such as natural increase and in-migration.

The combinations of factors affecting south shore growth will also affect growth in nearby areas. This effect, described as spillover, is shown in Table 8. As shown, Scenarios 4 and 5 would generate the largest spillover, and Scenarios 1 and 2 would generate the least. Spillover is most likely to go to the Carson Valley areas of Douglas County given the proximity, desirability, and large potential for housing development in the valley. Spillover is much less likely to go to the north shore, Carson City, or Alpine County. Alpine County has several potentially developable areas, but will likely be developed only as a consequence of extensive pressure to do so and will likely not be developed with housing that is affordable to most south shore employees. While it is most likely that the spillover will occur in the Carson Valley areas of Douglas County, it is assumed, for the purposes of impact assessment in some issue areas, that 5 percent of the spillover could go to Alpine County.

DESCRIPTION OF SOCIO-ECONOMIC CHARACTER UNDER GROWTH SCENARIOS

Under all scenarios, the south shore will continue to become more urbanized. Although growth will not change the essential nature of the area as a recreation and resort community, the magnitude and types of activities and development affect its character. In general, growth is likely to effect more noticeable changes in portions of DCSID since the percentage increase over present conditions there is greater than in STPUD.

For all scenarios, the growth of visitors is expected to exceed the growth of residents, so that visitors represent a larger share of the population in future years. Of the visitors, the share who come for the day (as compared with overnight) increases slightly in the future, being a little larger for Scenarios 1 and 4 than for Scenarios 2, 3, and 5. Included as overnight visitors are those staying in hotels/motels, second homes, campgrounds, and private residences with friends and relatives. Those staying in hotels/motels and second homes represent the largest shares of total overnight visitors (about one-third of the total for each), and campers represent the smallest share (about 6-10 percent).

Use of the housing stock (as measured by persons per unit and housing occupancy rates) increases under all scenarios as a result of housing shortages and changes in the mix of types of units and in usage patterns. Such changes occur primarily in STPUD (where new housing will be single family and a large share used for second homes) and to a lesser extent in DCSID (where new housing will be more similar to existing stock).

Under Scenarios 1 and 2, the character of the south shore would be more residential, somewhat less dependent on gaming and other commercial activities, and somewhat more oriented to outdoor recreation activities. Under both scenarios, the expansion of gaming activity is limited, much of the development would be housing, and the expansion of outdoor recreation and camping facilities (similar under all scenarios) represents a greater relative share of expanded recreation opportunities. A major difference between these scenarios is the large addition of housing in STPUD under Scenario 2, a large share of which is likely to go to second home buyers. The availability of housing to this market accounts for much of the increase in the relative importance of visitors to the total population under this scenario. Changes in the Upper Carson River Basin are likely to be negligible under these scenarios.

Scenario 3 describes a medium growth level with development and activities in relatively similar proportions to 1978 baseline conditions. While levels of activity and population increase, the mix of activities and population groups is similar to the present, although somewhat more visitor oriented, and also similar to Scenario 1, although more oriented to gaming and related activities.

The significant expansion of gaming and related commercial facilities and accommodations under Scenarios 4 and 5 has a major influence on the character of the area, providing a major attraction for visitors and a source of significant employment. The limited development in STPUD under Scenario 4 intensifies visitor and commercial activities in DCSID, creating pressures for higher density development, and shifting to DCSID significant demand for housing and other visitor accommodations. The result is likely to be a significant change in DCSID, representing a near doubling of residents and a greater than fourfold increase in overnight visitors. Scenario 5 provides for high levels of residential development in STPUD and DCSID, distributing the growth over both areas and allowing for significant second-home usage of the new stock, such that total levels of activity and population increase most of all scenarios for both STPUD and DCSID. Spillover population into the Upper Carson River Basin, particularly under Scenario 4, would significantly affect the character of the Carson Valley and Alpine County, as the area would be transformed from a rural to an urban setting.

SENSITIVITY OF SCENARIOS TO CHANGES IN ASSUMPTIONS

Table 9 summarizes the likely effects on the growth scenarios of changes in assumptions. For each factor, the change is identified and evaluated assuming no change in assumptions about the other major factors. For example, the effect of changes in land use policy is considered assuming no change in casino development. The effects discussed apply to all scenarios.

As described, changes in assumptions can lead to more or less growth or to a different mix of activities and population groups for the same level of growth. While Scenarios 1 through 5 describe a wide range of probable futures, there are many possible scenarios within and outside of that range. Since it is likely that most scenarios will fall within the range of the five scenarios evaluated here, the impacts of growth for new scenarios are also likely to fall within the range of impacts identified in this EIS.

4. RELATIONSHIP OF SCENARIOS TO OTHER FORECASTS AND PROJECTIONS

As shown in Table 10, other forecasts and projections for STPUD and DCSID are generally encompassed by the five EIS growth scenarios. Differences among the various projections reflect different methodologies and study areas as well as differences regarding:

- choice of CTRPA or TRPA land use policies in STPUD (EIS assumes CTRPA policies)

SENSITIVITY OF SCENARIOS TO
CHANGES IN MAJOR ASSUMPTIONS

Table 9

FACTORS	CHANGE IN ASSUMPTION	NATURE OF CHANGE	AFFECT ON GROWTH SCENARIOS
LAND USE POLICIES AND LEVELS OF RESIDENTIAL DEVELOPMENT	TRPA policies in STPUD.	- Higher residential densities permitted. - Higher density commercial development permitted. - Possibility of new subdivisions.	- Some multiple unit housing would be built, but no major effect on scenarios. To extent that units are affordable to employees, spillover would be reduced as would second home occupancy. Desirability of condominiums as second homes would limit their availability to employees. - Somewhat larger share of commercial activity including hotels/motels in STPUD, smaller share in DCSID. - High growth scenario no longer represents buildout in STPUD under TRPA land use policies.
	Different levels of residential development in STPUD or DCSID.	More or less residential development.	- More residential development would result in less upward pressure on prices, less spillover, more employee households in south shore, and more second homes. - Less residential development would result in greater upward pressure on prices, more spillover, less employee households, and more second homes.
	Buildout of residential development in DCSID with no expansion of gaming activity.	Less casino expansion under Scenarios 3, 4, and 5; same level of residential development in DCSID.	Higher proportion of population would be residents; there would be less spillover, more second homes, and less pressure to increase housing prices.
CASINO DEVELOPMENT	Different levels of casino development.	More or less casino activity.	- More casino activity would result in more employment, more visitors, more employee households and less second homes in south shore, and more spillover. - Less casino development would result in less employment, less spillover, and more second home use of housing stock.

Continued

Table 9 Contd.

FACTORS	CHANGE IN ASSUMPTION	NATURE OF CHANGE	AFFECT ON GROWTH SCENARIOS
SECOND HOME DEMAND	Desirability of south shore as a second home location is affected by increase in activity there.		Given the area's unique recreational features, it is likely that upward pressure on second home prices would drop off rather than a decrease in second home occupancy. May result in increased availability of housing for employees.
PUBLIC LAND ACQUISITION AND/OR U.S. FOREST SERVICE FACILITIES	Declaration of a National Recreation Area and significant land acquisition.	If effect is to prohibit further casino development and significantly limit housing construction: If effect is as described above, plus a significant increase in Forest Service facilities for camping and outdoor recreation: Significant increase in facilities for camping and outdoor recreation.	then, growth would stop at some lower level such as that of Scenario 1 or possibly even Scenario 3. Comparisons between Scenario 5 and Scenarios 1 or 3 identify growth effects. then, growth of casinos and housing would stop as described above while growth of outdoor recreation activities and visitors would continue. Increase in outdoor recreation activities and visitors. Note: Forest Service plans which require wastewater treatment capacity in excess of contracted reserve may require that additional reserve be allocated to assure its availability, particularly if expansion is to occur after buildout of private sector development.
SPIILLOVER	Political climate in Carson Valley does not allow development to accommodate spillover.	In general: If actions taken to severely limit amount of residential development: If actions taken to affect density of development and type and price of housing:	Mix of population in south shore would be affected more significantly than level of development or activity there, particularly for peak day population upon which most of impact assessment is based. then, somewhat more intensified use of south shore would occur; population would include more residents, less overnight visitors, and probably more day visitors. Those interested in second homes may look to north shore or Alpine County. then, most south shore spillover is still likely to go to Carson Valley since it would still be relatively best place for affordable housing; however, spillover may include a somewhat higher income group. There would be more doubling up of lower income employees in south shore and possibly less second home use of housing stock.

- estimates of buildout population in DCSID under TRPA policies (EIS generally shows higher estimates based on maximum possible densities)
- estimates of visitor populations (EIS estimates are generally higher than others)

No other projections here include spillover to Carson Valley.

SCENARIOS FOR AIR QUALITY MAINTENANCE PLANNING

Projections recently developed for air quality maintenance planning (AQMP) as part of the "Nonattainment Plan" provide projections of housing and hotel/motel growth. For STPUD, the AQMP projections approximate Scenarios 2 and 5, are slightly above Scenarios 3 and are substantially greater than Scenarios 1 and 4. For DCSID, Scenario 3 falls between the low and high AQMP projections. Scenario 5 is slightly higher and Scenario 4 is substantially higher than the high AQMP projection. Scenarios 1 and 2 fall below the low AQMP projection. In essence, the AQMP projections for both STPUD and DCSID fall within the range of EIS growth scenarios. The AQMP work also projected higher casino levels (at an upper limit of 450,000 square feet) than those projected for all scenarios; Scenarios 4 and 5 are the closest.

STATE WATER RESOURCES CONTROL BOARD PROJECTIONS AND CTRPA BUILDOUT

Excluding day users, SWRCB population growth projections for STPUD are similar to the growth projected under EIS scenarios (although the scenarios also include higher growth levels). Population totals differ, however, because the EIS work shows a higher 1978 baseline population. Visitor estimates seem to be the basis for most of this difference.

CTRPA buildout population estimates are very similar to estimates for the high growth scenarios.

TRPA SCENARIOS AND PROJECTIONS

Scenarios prepared for TRPA appear to cover a wider range of growth alternatives than do the EIS scenarios. It is difficult to make comparisons, since most of the TRPA information is provided for the entire Tahoe Basin.

Comparisons with TRPA population estimates (excluding day users) show that the EIS scenarios are higher for DCSID and lower for STPUD.

TABLE 10

COMPARISON OF EIS GROWTH SCENARIOS
AND OTHER SCENARIOS AND PROJECTIONS

	EIS			Other Scenarios ¹	
	Summer peak population excluding day users	Total (year 2000)			Ultimate
El Dorado Co.		103,890 - 143,700 (STPUD only)			156,840
Douglas Co.		29,670 - 77,350			48,730
Peak population excluding day users					
STPUD	Growth (1978-2000)	Total (year 2000)	Growth (1979-2000)	Total (year 2000)	
	27,630 - 67,440	103,890 - 143,700	25,305 - 47,878	76,551 - 102,552	
Housing units	Housing Units (year 2000)		Housing Units (year 1995)		
El Dorado Co.	18,655 - 26,583 (STPUD only)		14,590 - 39,760		
Douglas Co.	4,652 - 11,218		2,660 - 13,840		
Peak population in housing units					
STPUD	Total (year 2000)		Buildout of Subdivided Land		
	55,550 - 81,140		81,309		
Housing and hotel/motel units					
STPUD	Growth (1978-2000)	Total (year 2000)	Growth (1976-1995)	Total (year 1995)	
DCSID	3,072 - 13,800	27,105 - 37,833	13,847	36,392	
	2,667 - 16,183	7,862 - 21,378	4,505 - 9,269	9,163 - 13,927	

¹ Other Scenarios:

Summer peak population excluding day users: TRPA, Housing and Community Development Element, April 1978;
 Peak population excluding day users: SWRCB preliminary projections, November 1978, based on Dept. of Finance
 county D-100 and E-O population projections disaggregated to subcounty area using Caltrans model;
 Housing units: TRPA, Impact Assessment: Proposed Tahoe Regional Plan, April 1978;
 Peak population in housing units: CTRPA, May 1979;
 Housing and hotel/motel units: Air Quality Ad Hoc Committee, for Air Quality Maintenance Planning, November 1978.

B. WASTEWATER MANAGEMENT ALTERNATIVES

Alternative plans for wastewater management in the study areas were developed in response to water quality problems associated with the existing treatment facilities. Evaluations of wastewater management alternatives were prepared for the facilities planning documents (Culp, Wesner & Culp, 1978; Creegan & D'Angelo, 1978) according to regulations and guidelines of the U.S. Environmental Protection Agency, the California State Water Resources Control Board (SWRCB), and the Nevada Environmental Protection Services. This section describes existing wastewater facilities, viable project alternatives drawn from the facilities plans, and new alternatives developed during the course of this study.

I. EXISTING WASTEWATER FACILITIES

The major constraint on wastewater management in the Lake Tahoe Basin is the requirement, an agreement between California, Nevada, and the federal government in 1969, that all treated effluent must be exported from the basin. The service area boundaries and the location of major wastewater facilities for the South Tahoe Public Utility District (STPUD) and Douglas County Sewer Improvement District (DCSID) are indicated in Figure 1 and 2. The characteristics of these and other community wastewater management systems in the study area are described briefly below.

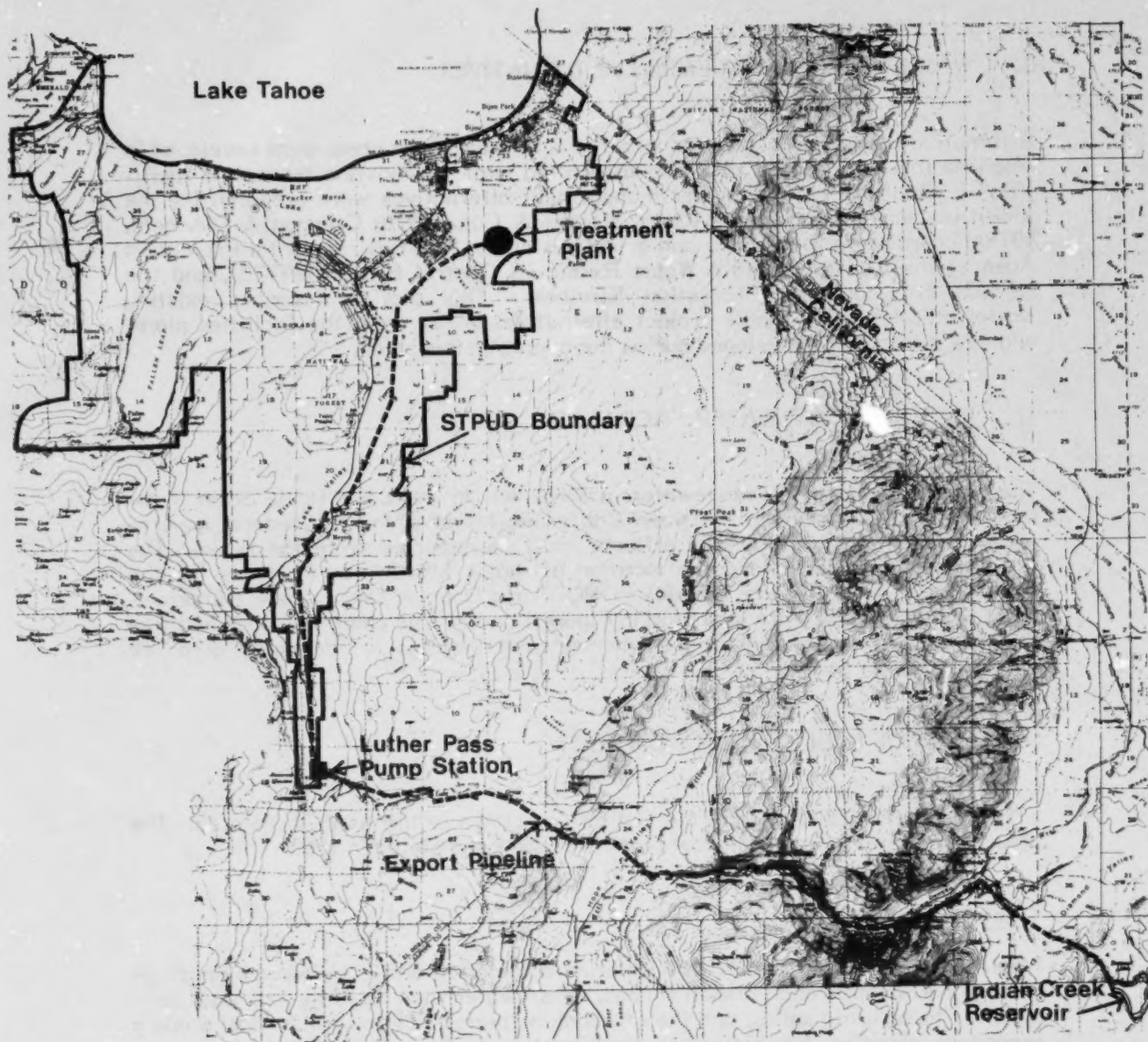
SOUTH TAHOE PUBLIC UTILITY DISTRICT

STPUD serves 21,000 acres in the California portion of the south shore area. The present treatment plant and export facilities were completed in 1968.

Treatment Process

Wastewater treatment begins with chlorine application and is followed by passage through barminutors and Parshall flumes. Wastewater then flows through a primary clarifier to separate solids, and then through activated sludge aeration basins and a secondary clarifier for biological treatment. A lime flocculation basin and chemical clarifier remove suspended solids and most phosphates. As wastewater leaves the ammonia stripping ponds, it is recarbonated with carbon dioxide to reduce the pH. Filtration on mixed-media separation beds filter out remaining turbidity, phosphates, and calcium carbonate. Treatment through activated carbon columns removes color, odor, and most of the remaining organic material. The effluent receives a final chlorination before leaving the plant.

The waste-activated sludge is thickened, combined with the primary sludge, dewatered, and incinerated. The lime sludge is reclaimed in a second furnace, thickened in a gravity-flow thickener, and dewatered. The lime sludge containing most of the phosphates is incinerated with the organic sludges to produce a sterile ash, which is hauled out of the Lake Tahoe Basin by independent refuse disposal companies.



miles

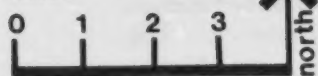


Figure 1
STPUD WASTEWATER FACILITIES
AND SERVICE AREA

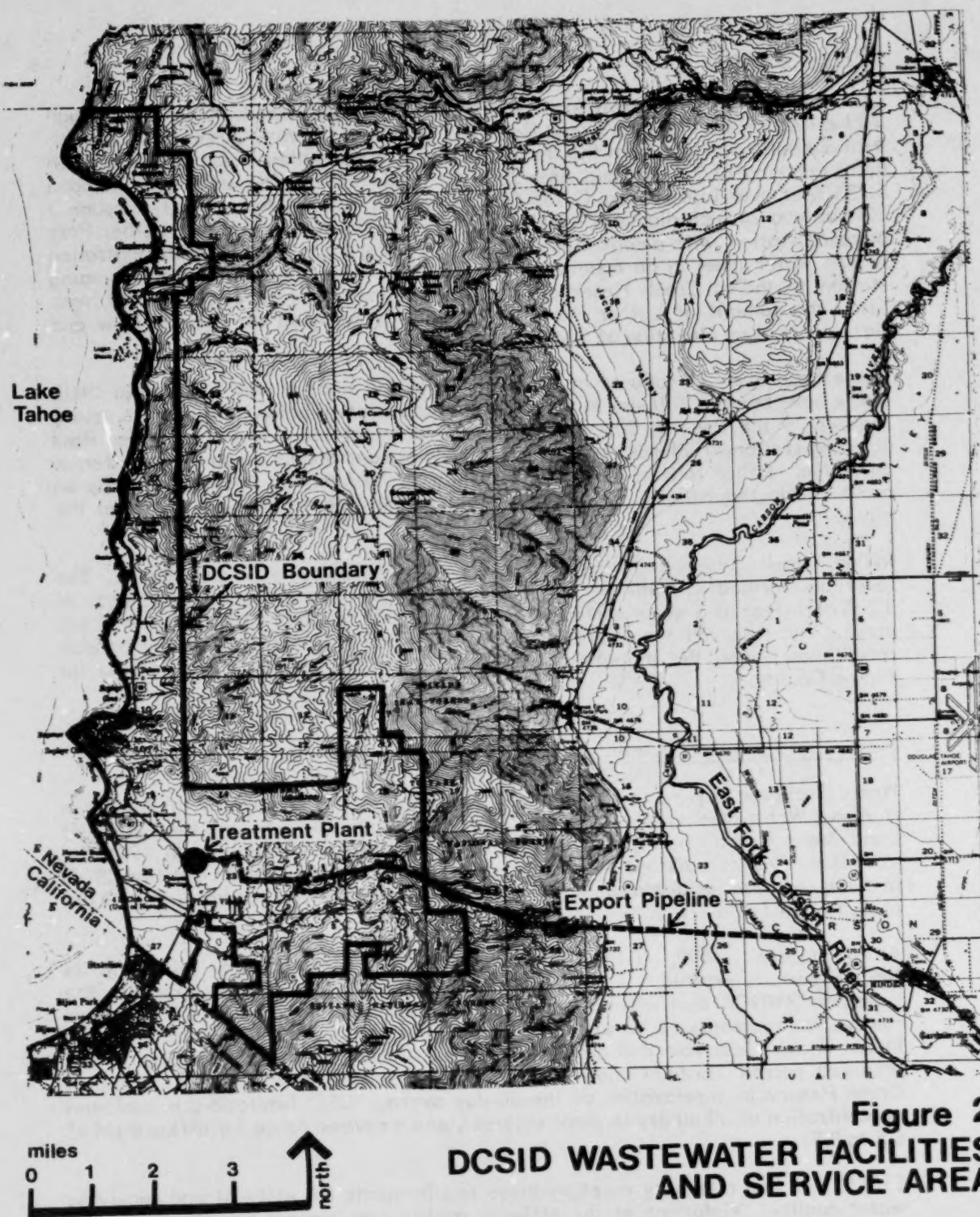


Figure 2
DCSID WASTEWATER FACILITIES
AND SERVICE AREA

Effluent Disposal

Effluent from the treatment facility is pumped in stages over Luther Pass through a 27-mile pipeline to Indian Creek Reservoir in Alpine County, California. The 24-inch diameter pipeline from the treatment plant to the Luther Pass pumping station has a capacity of 9.0 mgd and rises 257 feet in elevation. The effluent is pumped 1,235 feet over Luther Pass (7,735 feet above sea level at the summit) through a 20-inch and 24-inch diameter steel pipeline. The three pumps at the Luther Pass pumping station, with a combined capacity of 8.7 mgd, are automatically controlled by the water level in an equalization reservoir. From the Luther Pass pumping station to Indian Creek Reservoir, the export line has a capacity of 15.0 mgd. From the summit of Luther Pass, the pipeline is designed for gravity flow and terminates at an elevation of 5,600 feet.

There have been 21 failures in the export pipeline since it was installed in 1968. There have been 13 failures in the high pressure section below Luther Pass, and 8 failures in the low lift line between the treatment plant and the Luther Pass pumping station. Failures have occurred at joints and appear to be due to internal corrosion. Other failures have occurred where the pipe was installed directly on rocks within the bedding area and where back-fill operations have damaged the pipes.

Indian Creek Reservoir is on a normally dry tributary of Indian Creek. The reservoir, formed with the construction of two dams, has a maximum capacity of 3,225 acre-feet at a water surface elevation of 5,600 feet and a surface area of 165 acres. The reservoir stores reclaimed water, which is disposed of on downstream ranchlands during the irrigation season, and provides recreation and fishing for Alpine County.

Waste Discharge Requirements

Waste discharge requirements have been placed on STPUD effluent by the Lahontan Regional Water Quality Control Board (RWQCB), Alpine County, and the Bureau of Land Management (BLM), which controls Indian Creek Reservoir. In 1974 the Lahontan RWQCB modified its requirements to include a limit on pH and total BOD and suspended solids discharged per day. The original and current requirements are presented in Table II.

As of January 1, 1979, STPUD's waste discharge requirements, as defined in its NPDES permit, expired. A renewal permit is presently being proposed by the Lahontan RWQCB that will extend the permit another five years and will include revised requirements to govern the character of the discharge and its effect on Indian Creek Reservoir and downstream agricultural reuse of the effluent. The proposed permit contains more stringent requirements on discharges to Indian Creek Reservoir, a relaxation of the 30-day average COD limitation, a minimum concentration of alkalinity in plant effluent, and a revised range for effluent pH of 6.5 to 8.5.

STPUD has had difficulty meeting these requirements for effluent and receiving water quality. Violations of the effluent quality requirement for pH, BOD, and COD have occurred. Measurements taken on Indian Creek Reservoir also indicate continued violations of pH and ammonia nitrogen standards.

TABLE II
WASTE DISCHARGE REQUIREMENTS
SOUTH TAHOE PUBLIC UTILITY DISTRICT

EFFLUENT WATER QUALITY STANDARDS

Description	Original Requirements				Current Requirements			
	Alpine Co.	Lahontan RWQCB Percent of Time			Alpine Co.	Lahontan RWQCB		
		50	80	100		30 Day Avg	Max Consec 7 day Avg	Max
MBAS, mg/l, less than	0.5	0.3	0.5	1.0	0.5	0.3	0.5	1.0
BOD, mg/l, less than	5	3	5	10	5	3	5	10
BOD, lb/day, less than	No Requirement	No Requirement			No Requirement	187	312	625
COD, mg/l, less than	30	20	25	50	30	20	25	50
Suspended solids, mg/l, less than	2	1	2	4	2	1	2	4
Suspended Solids, lb/day, less than	No Requirement	No Requirement			No Requirement	62	125	250
Turbidity, JTU	5	3	5	10	5	3	5	10
pH, Units	6.5-8.5	6.5-9.0			6.5-8.5	7.0-7.5		
Coliform, MPN/100 ml	Adequately disinfected	Median less than 2; Max. no. consecutive samples greater than 23,2			Adequately disinfected	Median less than 2; Max. no. consecutive samples greater than 23,2		

INDIAN CREEK RESERVOIR WATER QUALITY STANDARDS

Description	Requirements - Lahontan RWQCB	
	Average	Maximum
pH, less than	8.4	8.6
Ammonium and ammonia -N, mg/l, less than	4.0	6.0
Dissolved sulfide, mg/l, less than	---	0.1
Dissolved oxygen, mg/l, minimum	---	(minimum)

Although STPUD met the original 6.5 to 8.5 pH range established by Lahontan RWQCB from 1970 to 1973, numerous violations have occurred after the standards were made more stringent. 1977 modifications were made to the acid and alkaline feed facilities and the pH monitoring and control system. At present, there are two systems for lowering pH (carbon dioxide and chlorine), two for raising pH (lime and sodium hydroxide), and two for regulating pH (automatic and manual). The pH can now be continuously measured and recorded at all key points. STPUD has been in compliance with the pH standard as a result of the 1977 modifications since January 1978.

From 1968 to 1970, the plant reclaimed water that met maximum BOD requirements continuously and only slightly exceeded the average BOD requirements three times. During 1976 and 1977, the maximum BOD limit was exceeded for three months, and the average limit was exceeded for five months. The most likely explanation for the decline appears to be loss of key experienced plant personnel and increased carbon loading.

The average and maximum COD requirements were met from 1968 to 1973, but were violated many times since 1974. The principle reason is that COD concentrations of raw wastewater are 50 to 80 percent higher than before 1973. The average and maximum daily flow have increased 18 percent since 1973, indicating that the increase of COD is due to higher organic loading rather than higher hydraulic loading. Interim plant modifications were made in late 1977 to alleviate the high COD in the effluent. The COD standard has been met since December 1977.

In 1972 and 1973, free ammonia concentrations in Indian Creek Reservoir resulted in fish kills. During the spring of those years, algae growth was sufficient to extract carbon dioxide from the water, thus raising the pH and thereby producing toxic levels of ammonia gas. To alleviate this problem, a surface aerator was added to one of the ammonia stripping ponds.

Current Flows and Capacity

Although the original design capacity of the STPUD treatment plant was 7.5 mgd, based upon maximum daily flow, the Lahontan RWQCB has based its revised NPDES permit on a maximum daily flow of 7.0 mgd. This figure was reached after reviewing capacity considerations (the treatment plant is unable to meet current waste discharge requirements at a maximum daily flow of 7.5 mgd) and a report on operation of the facilities by STPUD's consulting panel. The report established the effective plant capacity at 7.0, and not 7.5 mgd, because of limitations in the ability to pump effluent to the emergency holding pond.

DOUGLAS COUNTY SEWER IMPROVEMENT DISTRICT NO. 1

DCSID provides wastewater treatment and disposal for several districts in the Nevada portion of the south shore area. In addition to those areas within the DCSID, the service area includes the Kingsbury General Improvement District, the Round Hill General Improvement District, the Elk Point Sanitation District, and the Tahoe Douglas District. The service area contains all of the casinos in the south shore area as well as residential, commercial, and tourist-oriented development.

Treatment Process

The DCSID wastewater treatment plant is an activated-sludge secondary facility. The treatment process involves pretreatment, primary clarification, settling, aeration, and secondary clarification. Sludge from the process is thickened, dewatered, and incinerated.

Effluent Disposal

The effluent from the secondary clarifiers is pumped into a holding reservoir, which acts as a buffer to accommodate short-term peak flows. Treated wastewater from the holding reservoir is returned to the effluent pumping station. Where it is discharged to the East Fork Carson River at Muller Lane Bridge or onto land for irrigation during the growing season.

Waste Discharge Requirements

Discharge of treated effluent into the Carson River was originally controlled by a National Pollutant Discharge Elimination System (NPDES) permit issued by the U.S. Environmental Protection Agency. Recently, the Nevada Division of Environmental Protection has taken responsibility for the administration of the permit system and has issued new discharge standards. Interim standards are effective now; proposed effluent limitations, are to become effective January 1, 1982, and are significantly more restrictive for BOD, suspended solids, and total phosphate than the NPDES standards (see Table 12). In addition to reduced constituent parameters, the effluent limitations include limitations on TDS, un-ionized ammonia, chlorine residual, and nitrate that were not included in the NPDES permit. The interim Nevada Division of Environmental Protection standards are similar to federal permit conditions, except that the state limits the rate of discharge from 6.0 mgd to 3.0 mgd.

According to the facilities plan, in 1975 the plant plus the reservoir removed 97.3 percent of influent BOD and 95.1 percent of suspended solids. In 1976, 95.2 percent of BOD and 89.9 percent of suspended solids were removed by the plant and reservoir. There is no explanation for this degradation; but as a result, DCSID is not consistently meeting Nevada Division of Environmental Protection interim discharge requirements.

Capacity and Current Flows

The existing treatment plant has an annual average capacity of 3.0 mgd and is designed to expand to an ultimate capacity of 6.0 mgd in 1.5 mgd increments. The capacity of the export pipeline is 6.0 mgd. According to recent data, the current annual average flow rate is 1.3 mgd, and the maximum daily flow rate is 2.3 mgd. Periods of sustained maximum daily flow occur throughout the summer and during the holidays as a result of tourist activity, particularly in the casinos. As a result of this tourist activity, the difference between the monthly or weekly peak seasonal average flow and the single maximum daily flow is relatively small. The wastewater treatment plant has a design capacity of 4.8 mgd on a maximum daily basis, but because of current violations of effluent limitations, its effective treatment capacity is closer to present flows.

TABLE 12
EFFLUENT DISCHARGE LIMITATIONS
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION

GENERAL PROVISIONS:

The discharge shall not cause objectionable odors at the receiving waters.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

There shall be no discharge of toxic substances that cause violation of the water quality standards for the State of Nevada.

IMMEDIATE CONDITIONS (Effective through January 1, 1982)

Effluent Characteristics	Discharge Limitations					
	kg/day (lbs/day)		Other Units (Specify)			Daily Minimum
	30-day Average	7-day Average	Daily Maximum	30-day Average	7-day Average	
Flow	---	---	---	---	---	0.13 m ³ /s (3.0 mgd)
Suspended Solids	170 (375)	261 (575)	522 (1150)	15mg/l	23mg/l	---
BOD (5-day, 20°C)	170 (375)	261 (575)	522 (1150)	15mg/l	23mg/l	---
Total Phosphates (PO ₄)	---	---	---	---	---	---
Total Dissolved Solids	---	---	---	---	---	---
Unionized Ammonia	---	---	---	---	---	---
Ammonia Nitrogen (NH ₃ -N)	---	---	---	---	---	---
Nitrates (NO ₃)	---	---	---	---	---	---
Temperature	---	---	---	---	---	---
June-September	---	---	---	---	---	---
October-May	---	---	---	---	---	---
Settleable Solids	---	---	---	0.1ml/l	---	0.2ml/l
Fecal Coliform Bacteria	---	---	---	200/ 100ml	400/ 100ml	2000/ 100ml
Chlorine Residual	---	---	---	---	---	---
Dissolved Oxygen	Not less than 7.0 mg/l for the months of June through September nor less than 6.0 mg/l for any single sample.					
pH	Not less than 6.5 Standard Units nor greater than 8.5 Standard Units.					

TABLE 12 (Continued)

FUTURE CONDITIONS (Proposed to be effective January 1, 1982)

Effluent Characteristics	Discharge Limitations					
	kg/day (lbs/day)			Other Units (Specify)		
	30-day	Average 7-day	Daily Maximum	Average 30-day	7-day	Daily Maximum
Flow	---	---	---	---	---	0.13m ³ /s (3.0 mgd)
Suspended Solids	57 (125)	80 (175)	114 (250)	5mg/l	7mg/l	10mg/l
BOD (5-day, 20°C)	57 (125)	80 (175)	114 (250)	5mg/l	7mg/l	10mg/l
Total Phosphates (PO ₄)	1.14 (2.5)	1.48 (3.25)	1.70 (3.75)	0.10mg/l	0.13mg/l	0.15mg/l
Total Dissolved Solids	2840 (6255)	---	3407 (7506)	250mg/l	---	300mg/l
Unionized Ammonia	0.23 (0.50)	---	0.34 (0.75)	0.02mg/l	---	0.03mg/l
Ammonia Nitrogen (NH ₃ -N)	---	---	---	---	---	---
Nitrates (NO ₃)	23 (50)	34 (75)	45 (100)	2mg/l	3mg/l	4mg/l
Temperature						
June-September	No allowable temperature increase above natural receiving water temperature			20°C (68°F)	--	30°C (86°F)
October-May	Shall not exceed 3°C (5.4°F)			---	---	14°C (57°F)
Settleable Solids	---	---	---	0.1ml/l	---	0.2ml/l
Fecal Coliform Bacteria	---	---	---	200/ 100ml	400/ 100ml	2000/ 100ml
Chlorine Residual	---	---	0.11 (0.25)	---	---	0.01mg/l
Dissolved Oxygen	Not less than 7.0 mg/l for the months of June through September nor less than 6.5 mg/l for any single sample.					
pH	Not less than 6.5 Standard Units nor greater than 8.5 Standards.					

OTHER WASTEWATER SYSTEMS

The STPUD and the DCSID facilities are the largest community wastewater systems in the south shore portion of the basin. However, there are three other community systems that affect overall planning for wastewater management. These systems are particularly important when regional solutions to wastewater management are developed and evaluated.

Minden-Gardnerville Sanitation District

Minden-Gardnerville Sanitation District treatment plant has a design capacity of 0.5 mgd. It serves the town of Minden and Gardnerville and will most likely incorporate the Dressler Bench subdivision area in the near future. Although the plant has lost its inflow measuring ability, estimates indicate inflow peaks of 0.8 mgd. Infiltration is a severe problem because parts of the drainage system are over 70 years old. In average summer conditions, influent is estimated to be 0.31 mgd from domestic and commercial sources and 0.38 mgd from groundwater infiltration. Effluent is of relatively poor quality and does not meet secondary treatment standards. Effluent is discharged into the East Fork Carson River directly upstream from the DCSID outfall.

Incline Village Improvement District

The average flow capacity of the Incline Village Improvement District treatment plant is 3.0 mgd. The district serves the northeastern shore of Lake Tahoe and may soon annex the Crystal Bay area. The average daily flow between 1975 and 1977 was 0.666 mgd. In 1978 the average flow was 0.86 mgd. Maximum daily flows, occurring during periods of high tourist activity have climbed steadily from 1.0 mgd in 1975 to 1.3 mgd in 1978. Effluent quality is above that for normal secondary treatment plants. In the winter effluent is discharged 10 miles downstream from the DCSID outfall. In the spring, summer, and fall, effluent is used for irrigation in Jacks Valley and does not reach the Carson River.

Gardnerville Ranchos

A small part of the Gardnerville Ranchos subdivision, located south of the Minden-Gardnerville Sanitation District, is served by centralized wastewater facilities. The wastewater treatment facilities consist of two lagoons: the first operates as an oxidation pond, and the second polishes the effluent through aeration. The treatment ponds were designed to handle the flow from 220 residential units.

2. VIABLE PROJECT ALTERNATIVES

A number of alternative wastewater management plans were developed by both STPUD and DCSID for their respective areas. From among these alternatives, the districts selected the more viable plans after a screening process that involved determining technical feasibility, making preliminary cost estimates, and undertaking an environmental assessment. The viable project alternatives were then

subjected to a cost-effectiveness analysis which considered the economic, environmental, and social costs of the alternative plans over a prescribed period. Other factors considered were depletion of scarce resources, flexibility and reliability, potential for implementation, compatibility with local planning goals and objectives, flood protection, land use, and potential for reclamation.

Below are descriptions of the major features of the more viable project alternatives considered by STPUD and DCSID. Both alternatives presented in the original facilities planning documents and new alternatives developed during the course of this study are described.

SOUTH TAHOE PUBLIC UTILITY DISTRICT

Thirteen wastewater management plans were originally identified by STPUD. Based upon technical feasibility, requirements of California law, water quality criteria, and preliminary cost estimates, the original thirteen plans were narrowed to four basic plans, which were to be the subject of a detailed cost-effectiveness analysis. The nine alternatives eliminated during the screening process and the major reasons for their rejection are as follows:

- No project and continuation of existing system: Effluent quality would deteriorate as flows increase.
- Discharge secondary effluent to Indian Creek Reservoir: Existing requirements for maintenance of recreational water quality in Indian Creek Reservoir would present major implementation problems.
- Agricultural reuse of tertiary effluent: Costs would be prohibitively expensive; land leases or acquisitions involved may prevent future expansion; advanced treatment would remove nutrients valuable for agriculture.
- Direct discharge to the Carson River: Such discharge is currently prohibited by Lahontan RWQCB.
- Infiltration/percolation of tertiary effluent: Costs of tertiary treatment, construction of transport pipelines, and percolation basins would be prohibitive; agricultural reuse in the Diamond Valley would be precluded.
- Agricultural reuse of secondary effluent: Interagency agreement to operate joint system by STPUD and DCSID may be difficult to implement.
- Direct discharge into the South Fork American River: Contractual agreements to Indian Creek Reservoir would still have to be fulfilled; effluent would require a much higher level of treatment costs.
- Agricultural reuse of secondary effluent in the American River Basin: There are no appropriate sites within a reasonable distance.
- Groundwater replenishment in Upper Truckee Basin: Treatment by reverse osmosis would be required; existing California law requiring export of all wastewaters would be violated.

Under all five alternatives, numerous modifications to the existing secondary facilities would be required:

- construction of additional grit-removal basins
- structural changes to allow uniform flow into the inlet of the grit basins
- transportation of grit to location where containers can be served directly by waste disposal trucks
- increase in capacity of odor treatment system at the grit basin housing
- conversion of two primary sedimentation basins to sludge processing equipment, pipe gallery, and grit basin
- addition to a second sedimentation basin
- installation of system for flow equalization prior to biological and chemical treatment to allow the facilities to operate at maximum day conditions instead of maximum hour conditions
- conversion of aeration basins to flow equalization basins
- upgrading of secondary biological treatment process with activated biofilter
- installation of belt presses for sludge dewatering
- installation of new pumps in effluent transport system
- construction of parallel 18-inch export pipeline from treatment plant to Luther Pass pumping station when maximum daily flow approaches 9.0 mgd
- construction of new reservoir for adequate storage of projected wastewater flows; additional storage of 586 acre-feet for the 7.5 mgd plant, 1,288 acre-feet for the 10.0 mgd plant, and 2,784 acre-feet for the 15.0 mgd plant

Major differences in the five project alternatives lie in the extent of treatment and the type and location of effluent disposal. A summary of the five project alternatives is presented below.

Nitrification and Discharge to Indian Creek Reservoir (Alternative 1)

This alternative is intended to reduce the potentially toxic ammonia discharge to Indian Creek Reservoir by converting the influent ammonia to nitrate by biological nitrification. Nitrification would be achieved by exposing the bacteria in the system to oxygen for longer periods than for carbonaceous removal. An activated biofilter with extended aeration is recommended for this alternative.

The new reservoir for this alternative would be on land owned by the Heise Land and Livestock Company. The site is on the existing pipeline route and is above Diamond Ditch, which conveys irrigation water to farms in the Carson Valley. Water from the reservoir could be easily diverted by gravity into the head gates of

Diamond Ditch, and no ditch modifications would be required. Water from the transport pipeline or overflow from the new reservoir would be used to maintain the proper water level of Indian Creek Reservoir.

Nitrogen Removal Prior to Discharge to Indian Creek Reservoir (Alternative 2)

This alternative is intended to decrease the total nitrogen loading to Indian Creek Reservoir. After secondary treatment, the wastewater would be processed through chemical clarification, filtration, carbon adsorption, and selected ion-exchange systems.

As for Alternative 1, the Heise site was chosen for the new reservoir. The level of Indian Creek Reservoir would be maintained by overflow from the reservoir or with effluent from the export pipeline. Water from the new reservoir would be diverted to Diamond Ditch for irrigation.

Treatment Followed by Land Application Using Spray Irrigation (Alternative 3a)

This alternative would involve pumping secondary effluent to a new reservoir and abandoning the ammonia stripping towers, breakpoint chlorination, and carbon columns. The site for the new reservoir would be on the Gansberg Ranch in Alpine County, California. Water from this reservoir would be used by local farmers for irrigation using center pivot sprinkler irrigation systems. These areas are currently irrigated by private owners with water diverted from the West Fork Carson River.

The level of Indian Creek Reservoir would be maintained by water diverted from the West Fork Carson River through a water rights exchange. Currently, the Heise Land and Livestock Company has rights to 12,000 acre-feet of irrigation water per year from the river. This water is stored in Stevens Lake, located downstream of Indian Creek Reservoir. Under the proposed arrangements, Heise would trade Carson River water for secondary effluent.

Secondary Treatment Followed by Land Application Using Flood Irrigation (Alternative 3b)

This alternative also involves pumping secondary effluent to a new reservoir and abandoning the advanced wastewater facilities. The Heise property and the Pocket Ranch property northeast of the Heise site were selected as the reservoir sites.

Flood irrigation would require a tailwater collection system. Tailwater from the Heise property would be collected and pumped to Diamond Ditch, which would eliminate runoff to Indian Creek. Downstream water users would be supplied by a water rights exchange with the Heise Land and Livestock Company. The level of Indian Creek Reservoir would also be maintained by this exchange.

Land Application Plus an In-Basin Reuse Demonstration Project (Alternative 4)

In addition to the flood irrigation system of Alternative 3b, this alternative would include a 1.0 mgd advanced wastewater treatment facility for a pilot demonstration of in-basin reuse. The demonstration project would consist of chemical

clarification, filtration, carbon absorption, selective ion exchange, and reverse osmosis. The quality of the effluent from this process would be nearly equivalent to that of Lake Tahoe.

Reclaimed water could be used for golf course and green belt irrigation during the summer and for groundwater recharge during the winter. A small amount of snow-making could be included as a test for full-scale use. In-basin reuse would be continuously monitored to determine its feasibility as a long-term wastewater management plan.

Secondary Treatment Followed by Land Application in Carson Valley, Nevada (New Alternative)

During the course of this evaluation, a new alternative was developed that involves pumping secondary effluent over Luther Pass to a new reservoir site in Douglas County, Nevada. The existing advanced wastewater treatment facilities would be abandoned, and the export pipeline that transports effluent to Indian Creek Reservoir would be extended 9.0 miles to a new effluent storage reservoir site. Effluent from the reservoir would be diverted to the Dresslerville area of Carson Valley for use in an agricultural irrigation project.

Other benefits would involve possible energy recovery from the gravity portion of the export pipeline, as the available head between Luther Pass and the effluent storage reservoir would be significantly increased. Sufficient amounts of energy may be recovered for supplemental power for export pumping and/or operating irrigation facilities.

Recommended Alternative

Based upon the analyses presented in the facilities planning documents, STPUD recommended Alternative 3b. The recommended alternative was selected based upon a consideration of technical feasibility and economic and environmental considerations. When compared to the other alternatives, Alternative 3b had the most favorable combination of factors included in the cost-effective analysis. Major issues to be resolved for successful implementation of this alternative include approval of the use of secondary effluent in Alpine County, negotiation of an equitable water rights exchange, and determination of allowable project capacity.

DOUGLAS COUNTY SEWER IMPROVEMENT DISTRICT NO. 1

The facilities plan for the DCSID examined thirteen wastewater management plans. Based on technical, economic, environmental, and socio-political considerations, the district selected five of the thirteen for further consideration. The eight rejected alternatives and reasons for their rejection include:

- No project: Effluent cannot meet current waste discharge limitations.

- Advanced waste treatment at present plant site and indirect reuse within the Tahoe Basin: This alternative violates interstate agreement between California and Nevada.
- Advanced waste treatment at present plant site and direct reuse within the Carson River Basin: Due to uncertain health implications, direct reuse of wastewater for domestic use is not acceptable.
- Expansion of present secondary plant to 1995 flow projection, construction of an advanced waste treatment plant in the Carson Valley in conjunction with Minden-Gardnerville Sanitation District, and continuous discharge to the Carson River: As advanced waste treatment facilities could be added to the existing plant at less cost, expansion proposals are not cost-effective.
- Conventional treatment at existing plant site and land disposal on the east slope of the Carson Range; Would involve environmental concerns due to potential loss of wildlife browse.
- Conventional treatment at existing plant site and land disposal in the Pine Nut Mountain area: Land is owned by the Bureau of Land Management, which may not permit a long-term lease to be negotiated; increased transmission piping would make alternative less cost-effective.
- Conventional treatment at existing plant site and indirect reuse by groundwater recharge in Carson Valley: There is not sufficient evidence to show that wastewater constituents will be removed by horizontal movement through a saturated aquifer. This is of particular concern in small, generally high-level groundwater basins such as the Carson Valley.
- Abandonment of existing treatment facility (except reservoir, pumping, and transmission facilities), construction of a new conventional treatment facility in conjunction with Minden-Gardnerville Sanitation District, and joint disposal of the effluent to land in the Carson Valley: This alternative is not cost-effective when compared with an alternative involving only the DCSID.

The five alternatives that were studied in detail were selected after a cost-effectiveness analysis which included environmental and social considerations. Consequently, alternatives which appeared least costly were not necessarily considered for further study, and land disposal by irrigation in the water-short Carson Valley was considered. The land disposal alternative was expanded to four subalternatives, which differ in the method and site of irrigation. The five more viable alternatives are discussed below.

Advanced Waste Treatment and Continuous River Discharge (Alternative B-1)

This alternative would involve upgrading the existing system to remove nitrogen and phosphorus. The existing on-site storage reservoir would still be used, but additional effluent transfer pumps and export pumps would be required. Effluent from the advanced waste treatment facilities would be discharged into the East Fork Carson River on a continuous basis.

Advanced Waste Treatment and Seasonal River Discharge (Alternative B-4)

This alternative would involve expanding and upgrading to advanced wastewater treatment with phosphorus removal only. The effluent disposal facility would consist of a large storage reservoir in the Carson Valley and discharge line to the Carson River below the Muller Lane Bridge. At this location, the annual average phosphorus limitation in the permit allowed by the Nevada Division of Environmental Protection is 0.5 mg/l instead of the 0.1 mg/l specified above the bridge. Discharge to the river would occur only when the flows are high enough to dilute the effluent. The alternative would require the Nevada Division of Environmental Protection to establish a "zone of mixing", which is the volume of water near the point of discharge in which mixing occurs. The state permit allows one-third of the stream cross section to be used as a zone of mixing, and the remaining two-thirds of the stream to be used as a zone of passage. By restricting discharge of effluent during warm- and low-flow months, the quality of the Carson River would be improved. In addition, the need for nitrogen removal would be eliminated, and the need for a high degree of phosphorus removal would be reduced.

Advanced Waste Treatment and Seasonal River Discharge with Minden-Gardnerville (Alternative B-5)

This alternative is technically similar to Alternative B-4, except that disposal would consist of both land and river discharge and would be a combined project with the Minden-Gardnerville Sanitation District. A new reservoir and disposal facilities would be constructed: the existing discharge line from Muller Lane Bridge to the holding reservoir would be extended; a pumping station to pump from the reservoir, a force main from the reservoir to the river and from the reservoir to the irrigation site would be constructed; a sprinkler irrigation system would be installed. A pumping station would also be included in the irrigation system. Purchase and/or long-term leases for a reservoir and irrigation site would be necessary to implement this alternative.

Because the facility would be a joint effort between DCSID and the Minden-Gardnerville Sanitation District, the volume of effluent would be greater, and a large storage facility and irrigation area will be required. Phosphorus removal would be required at both treatment plants for discharge into the Carson River. For land disposal, only secondary treatment would be necessary, which would reduce operating costs. Land disposal would occur only during the growing season for the irrigation of crops.

Secondary Treatment and Land Disposal (Alternative C-2)

This alternative would eliminate discharge to the Carson River and provide for disposal of secondary effluent by a land application system. Two subalternatives, Alternative C-2A and C-2D were investigated as part of the facilities planning study. Alternative C-2A would involve land disposal by sprinkler irrigation on land controlled by the DCSID in the Carson Valley. Alternative C-2D would involve long-term leases with private property owners in the Carson Valley who would accept wastewater from the DCSID storage reservoir for irrigation of their lands. Both alternatives would require construction of a storage reservoir of 2,260 acre-feet and reconstruction of the Carson Valley portion of the existing export pipeline,

including extension of the pipeline to the effluent storage reservoir. The land required for irrigation would be 1,750 acres.

Alternatives C-2A and C-2D differ in the ownership of the irrigation system and of the land to be irrigated. In Alternative C-2A, DCSID would install and own the irrigation system and land. In Alternative C-2D, DCSID would only install monitoring wells and a weather station to monitor the irrigation operation.

Secondary Treatment and Land Disposal with Minden-Gardnerville (Alternative C-5)

This alternative is identical to Alternative C-2A except that it includes surface-spread irrigation and is a joint effluent disposal project with the Minden-Gardnerville Sanitation District. It would require expansion of the secondary treatment facilities and new facilities for surface spread irrigation. The irrigation facilities would be similar to those described in Alternative C-2A except that they would be larger to accommodate the larger joint flow. A storage reservoir of 3,570 acre-feet and 2,770 acres of land for irrigation would be required.

Secondary Treatment and Land Disposal Through a Joint Dischargers Program (New Alternative)

During the course of this study, a new alternative was developed, and a preliminary evaluation was performed. This new alternative would involve a joint disposal project to use secondary effluent in the Nevada portion of the Carson Valley. The systems incorporated into the joint disposal project would include DCSID, the Minden-Gardnerville Sanitation District, the Incline Village Improvement District, STPUD, and Carson City. In addition to these major dischargers, the smaller systems in the Carson Valley, which may ultimately be connected to a regional system, might be included. These smaller systems are Gardnerville-Ranchos, Stewart Indian School, and the Medium Security Prison.

Such a project would offer several benefits. A joint project with the Minden-Gardnerville Sanitation District was originally investigated as part of the facilities planning study for DCSID. In this analysis, there appeared to be no significant technical or economic advantages to a joint project. However, it would appear that in fact, savings could be made through economies of scale by joint use of effluent disposal facilities.

The distribution of land for irrigation in the Carson Valley and the location of the effluent dischargers may make it advantageous to have two combined systems. A system in the northern part of Carson Valley could incorporate Carson City, the Incline Village Improvement District, and the smaller dischargers in that area. A combined system in the southern part of Carson Valley could incorporate DCSID, the Minden-Gardnerville Sanitation District, Gardnerville Ranchos, and possibly STPUD.

In addition to the economic advantages, a joint disposal project would mean that increased quantities of secondary effluent would be available for irrigation in the Carson Valley. This supplemental water could affect the size and timing of proposed water supply projects such as the Watasheamu Project for the Carson

Valley. The feasibility of this alternative is enhanced by the potential for energy recovery on the gravity portions of the export pipelines. Energy saved would provide supplemental power and reduce operating costs.

Recommended Alternative

Based upon the analyses presented in the facilities planning documents, DCSID recommended Alternative C-2A. The selection was based on technical feasibility, economics, and environmental considerations. When compared to the other alternatives, Alternative C-2A had the most favorable combination of factors included in the cost-effectiveness analysis. Alternative C-2A is considerably more costly than Alternative C-2D; however, it was concluded that ownership of the entire effluent disposal system would offer the most reliability for DCSID. Major issues to be resolved for successful implementation of this alternative would include identification of a specific effluent disposal site and determination of allowable project capacity. No additional treatment plant capacity would be required as part of this project. However, the proposed treatment plant modifications would improve process reliability, thereby allowing the plant to operate for longer sustained periods at the original design capacity, an annual average flow of 3.0 mgd.

The draft facility plan was released in January 1978; the district has since negotiated a long-term contract with a rancher in Carson Valley who will use all of the district's effluent for irrigation during the growing season. The rancher has the option of using some of the flow at other times, but if he decides not to, the district, according to its recommended alternative, would store the effluent in large reservoirs. Until storage facilities are constructed, DCSID will discharge to the East Fork Carson River. The district, however, is proposing to study the feasibility of intensive land application during the non-growing season. Disposal of effluent on land not controlled by DCSID, as well as land application during the non-growing season, during the winter, are not part of the district's preferred alternative, and would have to be addressed in a revised facility plan.

III. AFFECTED ENVIRONMENT, ENVIRONMENTAL EFFECTS and MITIGATION MEASURES

A. INTRODUCTION

I. PURPOSE

This chapter includes the results of three tasks which together help determine the feasibility and acceptability of the facilities alternatives and growth scenarios. The first task describes the area affected by the proposed expansion and improvement of the two wastewater treatment facilities that serve the south shore area of the Lake Tahoe Basin. One facility is operated by the South Tahoe Public Utility District (STPUD) on the California side of the basin, and the other is operated by the Douglas County Sewer Improvement District No. 1 (DCSID) on the Nevada side. The description of the affected area includes both natural and social environments. The natural environment includes water quality and water resources, geology and soils, biology, noise, air quality, and visual resources. The social environment includes land use, housing, transportation, recreation, public services, utilities, and cultural, historical and archaeological resources.

The second task of this chapter documents how the natural and social environments might be affected by implementation of the facilities alternatives. Two different types of effects are distinguished: direct effects (or primary impacts) and indirect effects (or secondary impacts). Direct effects typically occur at the same time and place as the project. Possible direct effects include disruption of traffic, creation of noise and dust, increased emission of air pollutants, and disruption of visual resources. The direct effects of the STPUD facility plan alternatives on specific sites are addressed in the Draft Environmental Impact Report on the STPUD Wastewater Facilities Planning Program, prepared by Jones & Stokes, 1978. The direct effects of the DCSID facility plan alternatives are documented in the Draft Facility Plan, prepared by Creegan & D'Angelo, 1978. These effects are summarized briefly in "Direct Effects (Primary Impacts)" below.

Indirect effects, or secondary impacts, are the long-term consequences of implementing a project. Such impacts may include consequences of the direct effects, other effects related to changes in land use and population growth, and effects on air, water, and other natural resources. The main purpose of this EIS is to evaluate the growth-inducing effects of the facilities improvement and expansion. To identify these impacts, five alternative growth scenarios were developed (see "Alternatives"). For each aspect of the natural and social environment, the impacts of growth under each growth scenario are assessed.

Impacts may be both beneficial and adverse. For example, a high level of population growth may increase the efficiency and reduce the costs of providing certain public services. At the same time, this level of growth may adversely affect the transportation network by causing congestion.

The third task of this chapter develops mitigation measures to minimize adverse environmental impacts directly attributable to the project. (These measures are not intended to mitigate problems that currently exist.) For aspects of the natural and social environment that would suffer significant environmental consequences, the discussion of mitigation measures includes a description of the measure, implementing agencies, effectiveness, cost and timing. For less significant consequences, feasible mitigation measures are identified but not discussed in detail. If it appears that important mitigation measures will not be implemented and that the environmental impacts are highly adverse, EPA has the option of not funding the project.

In effect, this chapter presents the existing conditions in the affected area, indicates how those conditions may change as a result of the project, and suggests methods for minimizing adverse consequences. This information will be crucial to EPA in making its decision on whether to fund the improvements and expansion of the sewage treatment facilities.

2. STUDY AREAS

The area that would be affected by the project alternatives includes two separate hydrographic basins, the Lake Tahoe Basin and the Upper Carson River Basin. The two sewage treatment plants under consideration for expansion and improvement are situated in the Lake Tahoe Basin and dispose of their treated wastewaters in the Upper Carson River Basin.

The service areas of both treatment plants are in the south Tahoe area. The service area of STPUD is the urbanized south shore on the California side. The service area of DCSID includes all of Douglas County within the Lake Tahoe Basin. The expansion of the STPUD treatment plant would accommodate growth on the California side of the south shore area. Improvements to the DCSID treatment plant would accommodate growth on the Nevada side of the south shore area.

Figure 3 shows the study area, including the various political jurisdictions, the STPUD and DCSID treatment plants, and their service and disposal areas.

LAKE TAHOE HYDROGRAPHIC BASIN

The Lake Tahoe Basin is a single geographic unit: a large, subalpine lake surrounded by the mountains of the Sierra Nevada on the west and the Carson Range on the east. The basin covers 512 square miles, at elevations from 6,223 feet at the lake surface to 10,881 feet at Freel Peak. The lake itself is 192 square miles, 22 miles long and 12 miles wide, and maintains a minimum surface elevation of 6,223 feet.

The largest of the 63 tributaries that drain into Lake Tahoe is the Upper Truckee River at the southern end of the basin. The only natural outlet of the lake is the

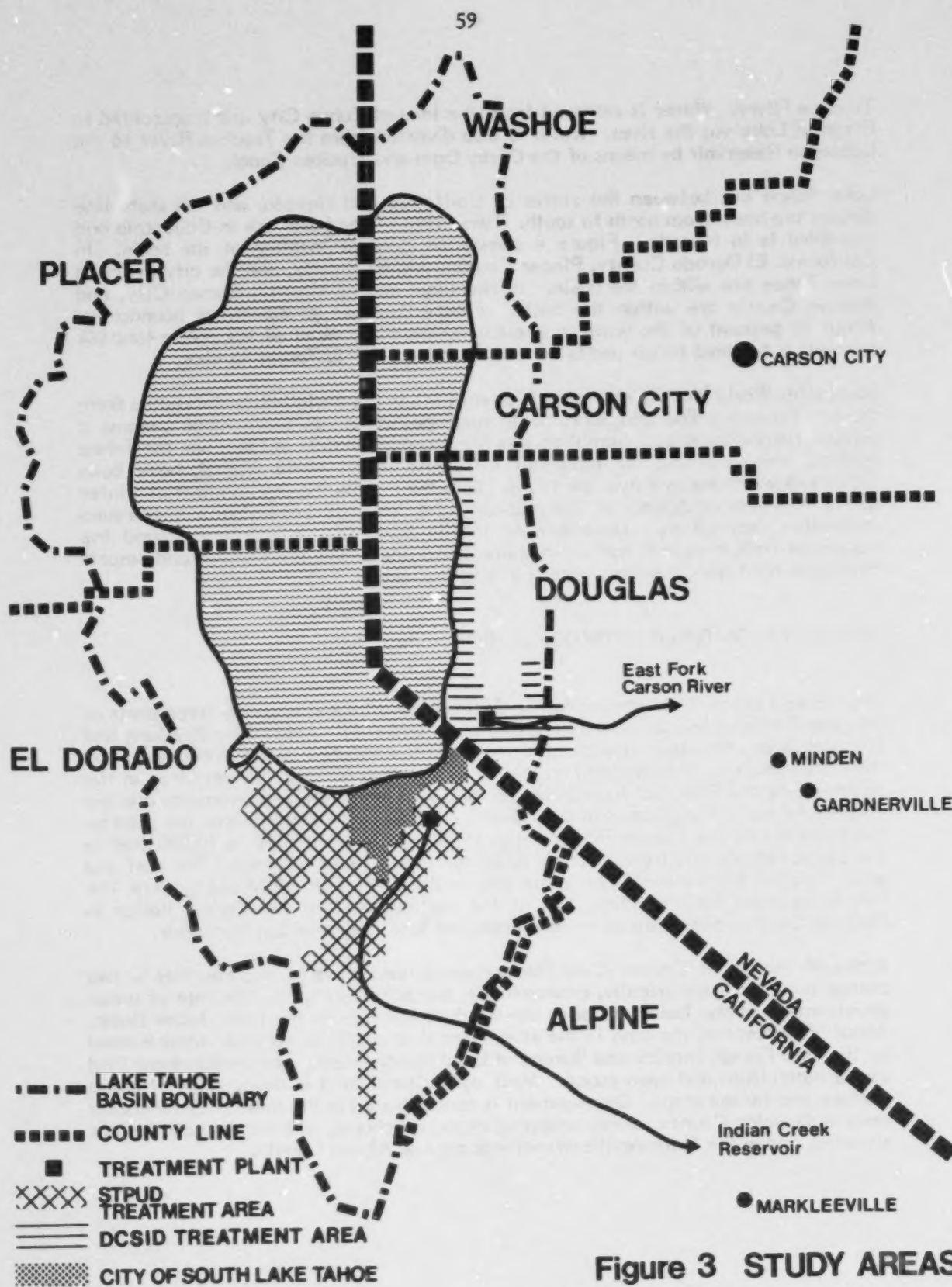


Figure 3 STUDY AREAS

Truckee River. Water is released from the lake at Tahoe City and transported to Pyramid Lake via the river. Water is also diverted from the Truckee River to the Lahontan Reservoir by means of the Derby Dam and Truckee Canal.

Lake Tahoe lies between the states of California and Nevada, and the state line divides the basin from north to south. Two-thirds of the basin are in California and one-third is in Nevada. Figure 4 shows the general location of the basin. In California, El Dorado County, Placer County, Alpine County, and the city of South Lake Tahoe are within the basin. In Nevada, Douglas County, Carson City, and Washoe County are within the basin. Figure 3 shows jurisdictional boundaries. About 70 percent of the basin is in public ownership. Most of the public land (64 percent) is national forest and is administered by the U.S. Forest Service.

Soon after World War II, when new highways made the basin easily accessible from the San Francisco Bay and Sacramento metropolitan areas, Lake Tahoe became a popular recreation area. Gambling was legalized in Nevada in 1931, and the Tahoe casinos, which became an important attraction after World War II, have been Tahoe's major industry since the 1950s. With the continuing development of winter sports and the expansion of the casinos, the basin is becoming a year-round recreation destination. Development in the basin is concentrated around the casinos at both the north and south shore state lines. Vacation homes and resorts have been built near the main roads circling the lake.

UPPER CARSON RIVER HYDROGRAPHIC BASIN

The Upper Carson River Hydrographic Basin study area encompasses large parts of Douglas County, Nevada, and Alpine County, California. About 52 miles long and 20 miles wide, the basin is separated from the Lake Tahoe Hydrographic Basin by the Carson Range. It is bounded on the north by Indian Hill and Carson City; on the southeast by the Pine Nut Mountains; on the south by the Desert Mountains and the Toiyabe National Forest; on the southwest by the Sierra Nevada; and on the west by the ridgeline of the Carson Range. Elevations range from 8,000 to 10,000 feet in the Sierra Nevada and from 5,000 to 8,500 along the Pine Nut range. The east and west forks of the Carson River drain the northeastern half of Alpine County. The two forks cross the state line, join at the northern end of the Carson Valley in Douglas County, and continue to flow northeast into the Lahontan Reservoir.

Although the Upper Carson River Basin encompasses parts of two counties in two states, the area is historically, economically, and socially a unit. The rate of urban development in the basin has been slower than the rate in the Lake Tahoe Basin. About 50 percent of the land in the study area is in public ownership, administered by the U.S. Forest Service and Bureau of Land Management. The predominant land use is agriculture and open space. Most agricultural land is devoted to irrigated pasture and forage crops. Development is concentrated in the Minden-Gardnerville area of Douglas County, where shopping centers, schools, and social facilities are situated, and in the Markleeville-Woodfords area of Alpine County.

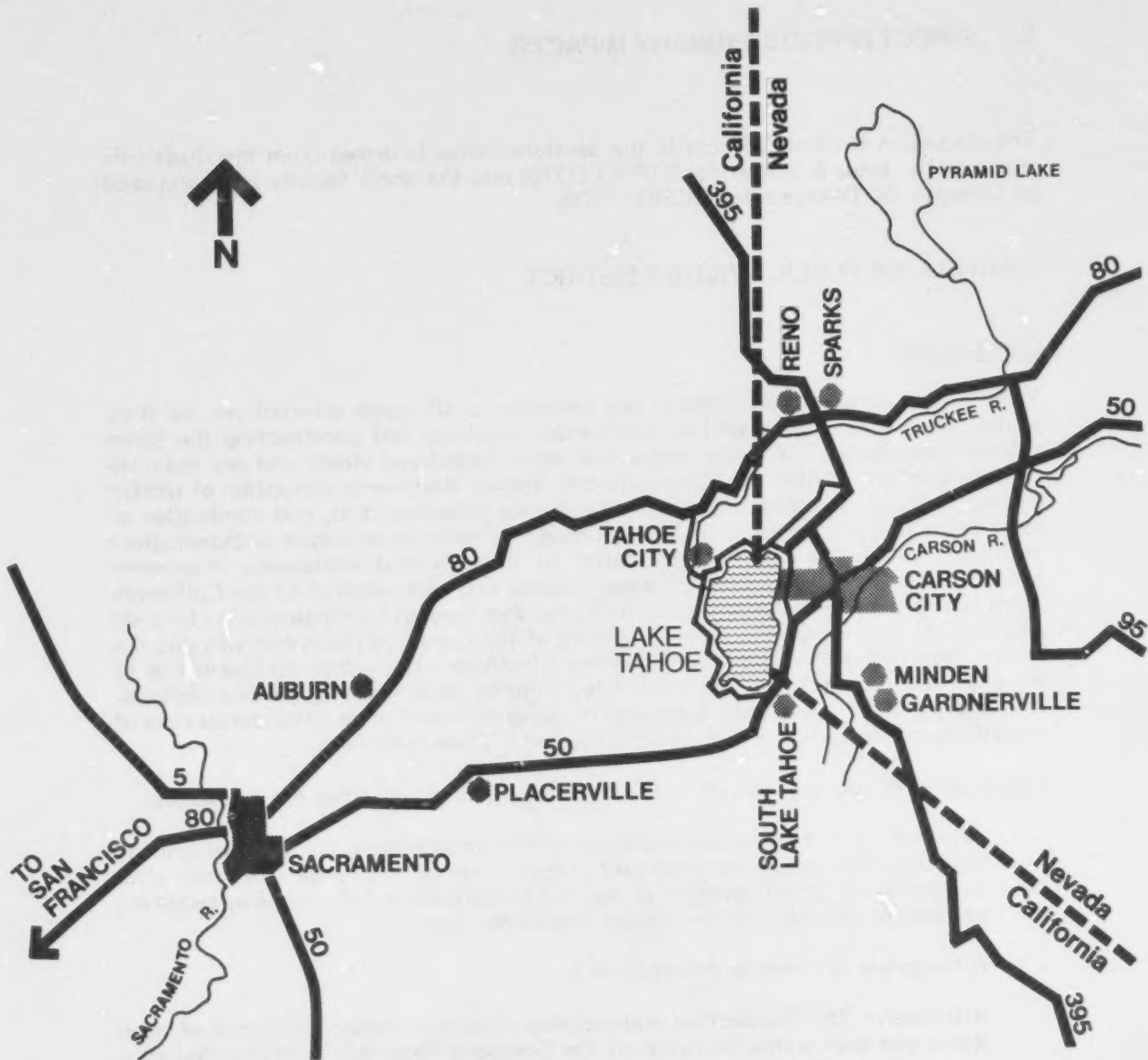


Figure 4
LOCATION MAP

B. DIRECT EFFECTS (PRIMARY IMPACTS)

The discussion of direct effects in the sections below is drawn from the draft EIR prepared by Jones & Stokes for STPUD (1978) and the draft facility plan prepared by Creegan & D'Angelo for DCSID (1978).

SOUTH TAHOE PUBLIC UTILITIES DISTRICT

Construction

Many of the construction impacts are common to all seven alternatives, as they would result from laying similar wastewater pipelines and constructing the same storage reservoirs. (Of these seven, five were considered viable and are the ones described in "Alternatives.") These impacts include short-term disruption of traffic and agricultural operations, creation of nuisance noise and dust, and elimination of open space and grazing areas in Alpine County. There are no known archaeological or historical sites within the boundaries of the proposed wastewater treatment facilities in El Dorado County. However, recent archival research at the California State Historical Preservation Office indicates that two archaeological sites (Alp-63 and Alp-15) are within a quarter of a mile of the Gansberg Reservoir site and the Pocket Ranch Reservoir site, and that one site (Alp-16) is within the boundaries of the proposed Pocket Ranch Reservoir site. Figures showing historical and archaeological sites in the two study areas and an appendix identifying sites and sources of record are available for review at EPA, Region IX, San Francisco.

The major construction impacts specific to individual alternatives are as follows:

- Alternative 1: Excavation and clearing of approximately 110 acres of grazing land and open space for reservoir construction at the Heise Reservoir site; inundation of a short stretch of natural streambed on Indian Creek, requiring permanent diversion of the stream around the site.
- Alternative 2: Same as Alternative 1.
- Alternative 3b: Excavation and clearing of approximately 120 acres of open space and deer wintering range at the Gansberg Reservoir site; creation of a visual distraction along a designated state scenic highway (Highway 89); temporary siltation of the West Fork of the Carson River from pipeline construction across the stream.
- Alternative 3bl: Excavation and clearing of approximately 211 acres of open space and grazing land at the Heise and Pocket Ranch Reservoir sites; inundation of Stevens Lake and a small stretch of Indian Creek; short-term disturbance from construction activity, noise and traffic in the vicinity of a planned 22-unit housing development at Woodfords Community Center.
- Alternative 4: Would include the construction impacts of Alternative 3bl, temporary disruption of residential and recreational land uses along irrigation delivery pipeline in the South Lake Tahoe area.

- No Action: No significant construction-related impacts

Operation

Impacts from operation of the seven proposed action alternatives can be divided into physical, social, and economic elements. The social impacts of the alternatives are similar (with the exception of land use conversions). Each would improve wastewater service to the same area and same population, thereby influencing growth in a similar manner. Differences in the operational impacts of the five viable alternatives are summarized in Table 13. Some of the key differences are discussed below.

The proposed expansion of irrigation could have an impact on soil and surface water quality in the Diamond Valley area if not properly managed. Both the secondary and tertiary effluents contain dissolved solids well in excess of current water supplies, but well below levels considered to be significantly adverse for long-term use. The flood irrigation options (1, 2, 3b1, 4, no action) all present a threat of surface water quality degradation. Both Indian Creek and the West Fork Carson River could be affected. Alternative 3 would eliminate most threats of runoff to surface waters through the use of sprinkler irrigation.

Each alternative has a slight potential for creating public health hazards in the Alpine County reuse area. Irrigation with reclaimed wastewater would be continued and expanded (except in no action). The major health threats come from bacterial or viral contamination of domestic groundwater supplies. Each alternative includes disinfection and percolation through the soil column, and treatment is sufficient to meet California Department of Health irrigation reuse requirements. The likelihood of contaminating wells in the Diamond Valley area appears to be small, as most are drawing water from considerable depths (in excess of 90 feet), but several shallow wells (20-100 feet) exist in alluvial material in the upper Carson Valley east of Paynesville. Irrigation in the vicinity of these wells should be closely monitored. The new wastewater storage areas could also pose a health threat; however, they would be fenced to restrict public access and managed to minimize increases in mosquito and midge populations.

DOUGLAS COUNTY SEWER IMPROVEMENT DISTRICT #1

The impacts associated with DCSID's project alternatives are summarized in Table 14. Any impacts resulting from plant improvements will be beneficial from an operational, peak capacity, and functional point of view. Only slight inconveniences due to the movement of trucks and construction equipment are expected during the construction phase. Adverse impacts are associated with improving and modifying the effluent disposal system. These impacts will occur in the Carson Valley where the export pipeline will be extended, a storage reservoir will be constructed, and irrigation and monitoring equipment will be installed.

Table 13 SUMMARY COMPARISON OF MAJOR OPERATIONAL IMPACTS ASSOCIATED WITH STPUD ALTERNATIVES

IMPACT CATEGORIES	IMPACT SUMMARY		
Energy and chemical consumption	Alts. 1 & 2 - highest requirements due to advance waste treatment Alt. 4 - intermediate due to in-basin demonstration AWT Alts. 3B1 & 3B3 - lowest due to simple flood irrigation and secondary treatment Alts. 3A and 3B2 - only slightly higher than 3B1 and 3B3 due to extra pumping No Action - per unit requirements greater than 3 but less than 1, 2 or 4		
Costs* (millions of dollars)	Construction Cost	Operation and Maintenance Cost**	Total Present Worth (1981-2001)
Alternative 1	27.1***	3.2	45.4
Alternative 2	34.1	3.3	51.9
Alternative 3A	30.0	2.2	39.0
Alternative 3B1	21.5	2.1	32.9
Alternative 3B2	24.0	2.1	NA
Alternative 3B3	23.0	2.1	NA
Alternative 4	26.6	2.9	41.9
No Action	.8	2.1	NA
* Assumes 10 mgd flow rate in 1990. ** Annual cost. *** Rounded to nearest \$100,000. NA No estimates made.			
Irrigation and water supply	Alts. 3B1, 3B2 & 3B3 supply most water for irrigation (8,901 acre-feet/year at 10 mgd) and require little change in agricultural operations in Alpine County Alt. 4 supplies 7,781 acre-feet/year - 1 mgd used for in-basin irrigation Alt. 3A supplies 7,631 acre-feet/year but requires major change in agricultural operations and cost Alts. 1 & 2 supply 7,552 acre-feet/year and no significant changes in agricultural operations No Action would continue to supply 2,600 to 3,500 acre-feet per year with no change in agricultural operations		
Soils and crops	Alts. 1 & 2 supply effluent with highest salt content but lowest suspended solids; small potential for slow accumulation of salts Alts. 3 & 4 have lower salt content but higher suspended solids - no major threat to soils Alt. 3A would create fewest problems of any action alternative - sprinkler irrigation No Action would create no soil or crop problems		
Public health	Alts. 1 & 2 - fewest hazards due to AWT Alts. 3B1 and 3B3 - some potential for health hazard due to secondary treatment, large area flood irrigated Alt. 3A - less threat than 3B1 and 3B3 due to reduced possibility of runoff or percolation Alt. 3B2 - less threat than 3B1 and 3B3 as irrigation confined to Heise property Alt. 4 - some potential for creating health hazard due to in-basin groundwater injection No Action - no significant public health hazards (same as Alts. 1 & 2)		
Indian Creek Reservoir quality, use	Alts. 3 & 4 - Carson River water substituted for wastewater; reduces nitrogen input; may remove reservoir from discharge requirements Alts. 1 & 2 - capable of solving water quality violations except possibly receiving water pH No Action - interim improvements could solve ICR water quality problems, except receiving water pH, but do not improve treatment reliability		
Land use conflicts	Alts. 1 & 2 - create no major conflict Alts. 3A, 3B2 & 3B3 - create scenic distraction on Highway 89 - Gansberg Reservoir Alt. 3B1 - Pocket Ranch Reservoir close to planned 22-unit housing development Alts. 3B1 & 3B2 - places secondary effluent storage reservoir (Heise) near ICR recreation area Alt. 4 - places irrigation system in open space/greenbelt area in Tahoe Basin. No Action - no new land use conflicts		

Source: Jones & Stokes Associates, Inc. 1978

Impact Description		Alternate B-5 AMT & Seasonal River Discharge (Joint Protect)				Alternate C-2A CT & Land Disposal on District Lands Solid Set Irriga- tion				Alternate C-2D CT & Land Disposal by Contract with Local Interests				Alternate C-5 CT & Land Disposal on Joint Owned Lands (Joint Protect)			
Facility Description Type of Treatment(1)		Alternate B-4 AMT & Seasonal River Discharge		Alternate B-5 AMT & Seasonal River Discharge (Joint Protect)		Alternate C-2A CT & Land Disposal on District Lands Solid Set Irriga- tion		Alternate C-2D CT & Land Disposal by Contract with Local Interests		Alternate C-5 CT & Land Disposal on Joint Owned Lands (Joint Protect)		Alternate C-2D CT & Land Disposal by Contract with Local Interests		Alternate C-5 CT & Land Disposal on Joint Owned Lands (Joint Protect)		Alternate C-2D CT & Land Disposal by Contract with Local Interests	
Type of Project		Partial AMT		Partial AMT		CT		CT		CT		CT		CT		CT	
Discharge		DCSID		DCSID		DCSID		DCSID		DCSID		DCSID		DCSID		DCSID	
Annual (MG)		1400		1400		1400		1400		1400		1400		1400		1400	
Reservoir Site (Ac.ft.)(2)		-0-		-0-		-0-		-0-		-0-		-0-		-0-		-0-	
Land for Disposal (Acres)		None Required		None Required		None Required		None Required		None Required		None Required		None Required		None Required	
Source of Disposal Land		None Required		None Required		None Required		None Required		None Required		None Required		None Required		None Required	
Cost Impacts - Present Worth		10.0		12.0		11.5		31.2		30.8		8.8		30.8		30.8	
Basis (millions of dollars)		None		None		None		Acceptable		Acceptable		Acceptable		Acceptable		Acceptable	
Total (includes both capital and M & O costs)		None		None		None		Acceptable		Acceptable		Acceptable		Acceptable		Acceptable	
Socio-Political Impacts		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Ability to Meet State Discharge Standards		District only		District only		District only		District only		District only		District only		District only		District only	
Control of Wastewater Management		State of the Art		State of the Art		State of the Art		State of the Art		State of the Art		State of the Art		State of the Art		State of the Art	
Technical Feasibility		Technology w/ phosphorus removal on the fringes of demonstrated practice		Technology State of the Art		Technology State of the Art		Technology State of the Art		Technology State of the Art		Technology State of the Art		Technology State of the Art		Technology State of the Art	
Environmental Impact		Increased use of chemicals and power charge during the dry season will reduce flows in existing site		Same as B-1. Eliminating dis- charge during the dry season will reduce flows in river.		Same as B-1. Eliminating dis- charge during the dry season will reduce flows in river.		Same as B-1. Eliminating dis- charge during the dry season will reduce flows in river.		Same as B-1. Eliminating dis- charge during the dry season will reduce flows in river.		Same as B-1. Eliminating dis- charge during the dry season will reduce flows in river.		Same as B-1. Eliminating dis- charge during the dry season will reduce flows in river.		Same as B-1. Eliminating dis- charge during the dry season will reduce flows in river.	
Negative		Positive improve- ment of water quality at the point of discharge into the East Fork of the Carson River		Improved water quality in river by eliminating dis- charge during dry season		Same as B-4		Same as B-4		Same as B-4		Same as B-4		Same as B-4		Same as B-4	
Positive		Beneficial usage of wastewater in an area which is water poor		Beneficial usage of wastewater in an area which is water poor		Beneficial usage of wastewater in an area which is water poor		Beneficial usage of wastewater in an area which is water poor		Beneficial usage of wastewater in an area which is water poor		Beneficial usage of wastewater in an area which is water poor		Beneficial usage of wastewater in an area which is water poor		Beneficial usage of wastewater in an area which is water poor	

Notes:

- 1) AMT = Advanced Waste Treatment consisting of secondary treatment + nitrogen and phosphorus removal + filtration.
CT = Conventional Secondary Treatment
Sec = Secondary Treatment
C.P.* = Chemical Precipitation for phosphorus removal
- 2) Does not include existing 75 ac-ft onsite storage reservoir.

Source: Creegan & D'Angelo, 1978

Table 14

SUMMARY COMPARISON OF MAJOR IMPACTS ASSOCIATED WITH DCSID ALTERNATIVES

C. INDIRECT EFFECTS (SECONDARY IMPACTS): WATER RESOURCES AND WATER QUALITY IN LAKE TAHOE HYDROGRAPHIC BASIN

Lake Tahoe, situated high in the Sierra Nevada, is renowned for its clarity, quality, and beauty. Among the lakes of the world, only Crater Lake in Oregon and Lake Baikal in the Soviet Union are comparable to Lake Tahoe in terms of the clarity and deep blue of their waters. The lake, enclosed by an impressive ring of mountains, provides visitors from around the world with a unique natural experience and year-round recreational opportunities.

I. WATER RESOURCES: EXISTING CONDITIONS

The Lake Tahoe Basin is dominated by the lake and is made up of 64 separate watersheds. The rivers and creeks that drain these watersheds are the greatest source of replenishment to the lake. The basin also includes two large groundwater basins, one along the west shore and one at the south end. The locations of these major bodies of water are shown in Figure 5. Physical characteristics of the lake are shown below:

Total surface area of basin	512 square miles
Land surface area	315 square miles
Lake Tahoe surface area	192 square miles
Small lake surface area	5 square miles
Lake elevation	6,223 to 6,229.1 feet
Maximum elevation of surrounding mountains	10,881 feet
Length of lake	22 miles
Width of lake	12 miles
Length of shoreline	71 miles
Maximum depth of water	1,645 feet
Average depth of lake	1,027 feet
Storage volume (top 6.1 feet)	720,000 acre-feet
Total volume	123,000,000 acre-feet

The waters of Lake Tahoe are replenished by tributary streams originating as rain or snow in the Sierra Nevada. An average of 648,300 acre-feet each year of precipitation and tributary runoff replenish Lake Tahoe, which is the water supply for in-basin communities and the Reno-Sparks-Fallon area of western Nevada (by means of the Truckee River).

Waters in Lake Tahoe mix slowly and leave slowly through the one outlet, the Truckee River. The Truckee River discharges an average of 181,500 acre-feet per year; the volume of Lake Tahoe is 123 million acre-feet. The outlet is controlled by a small dam at Tahoe City. At normal water levels, one percent of this total volume is controlled. The river flows from California into Nevada, where it terminates at Pyramid Lake. Exported wastewater and diversions are other sources of outflow from the basin. Wastewater exports have climbed from 1,250 acre-feet in 1968 to an average of 7,600 acre-feet between 1975 and 1977. Water diversions

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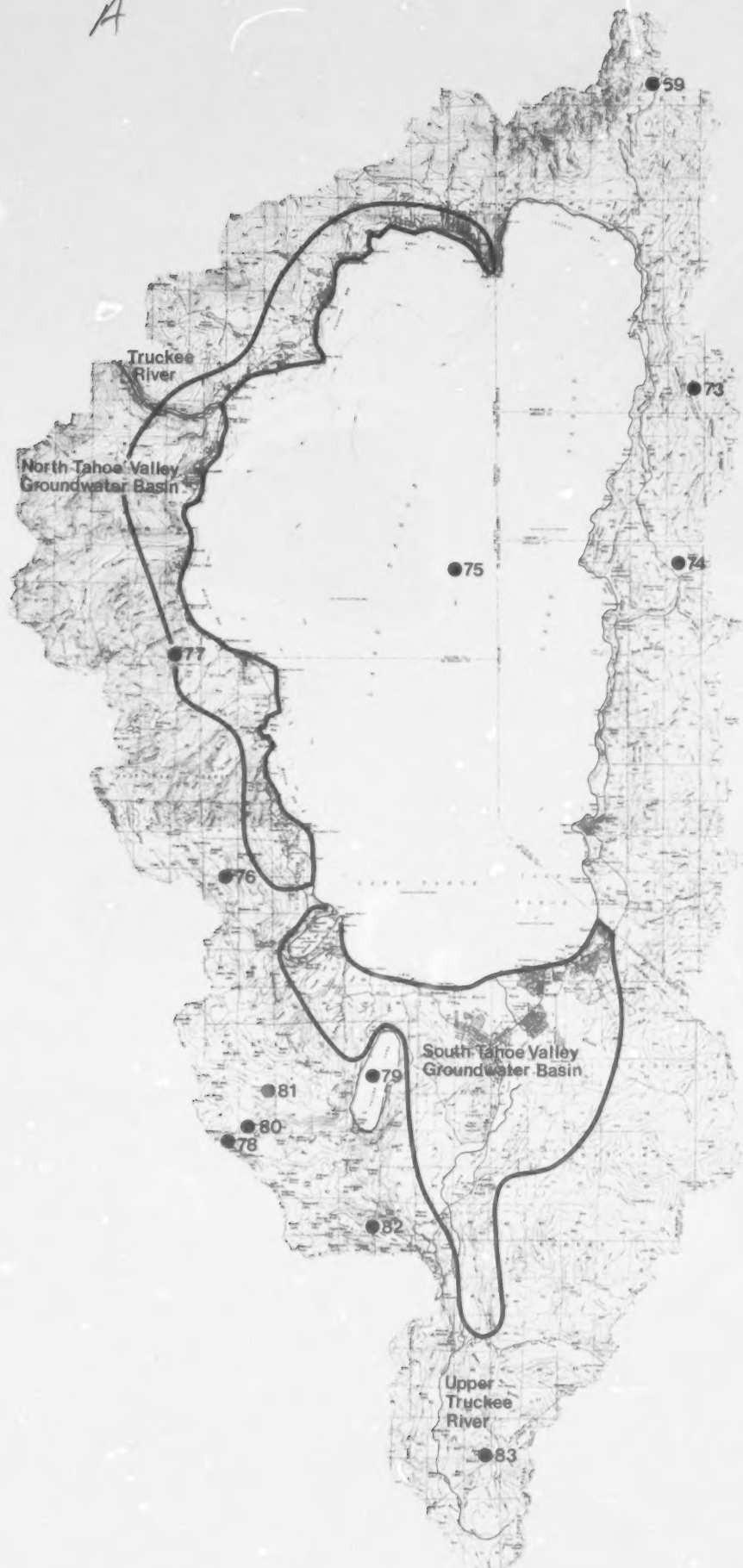




**Figure 5 WATER RESOURCES
LAKE TAHOE BASIN**



GROUNDWATER BASINS

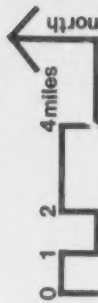


STORAGE RESERVOIRS

- | | |
|----------------------|---------------------|
| 69 INCLINE LAKE | 78 HEATHER LAKE |
| 73 MARLETTE LAKE | 79 FALLEN LEAF LAKE |
| 74 SPOONER LAKE | 80 SUSIE LAKE |
| 75 LAKE TAHOE | 81 GILMORE LAKE |
| 76 STONEY RIDGE LAKE | 82 ECHO LAKE |
| 77 QUAIL LAKE | 83 ROUND LAKE |

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B

3

from Echo Lake, Marlette Lake, and Third Creek average 5,100 acre-feet per year. the mean annual water budget for the Lake Tahoe Basin (1960-1974) is illustrated in Figure 6.

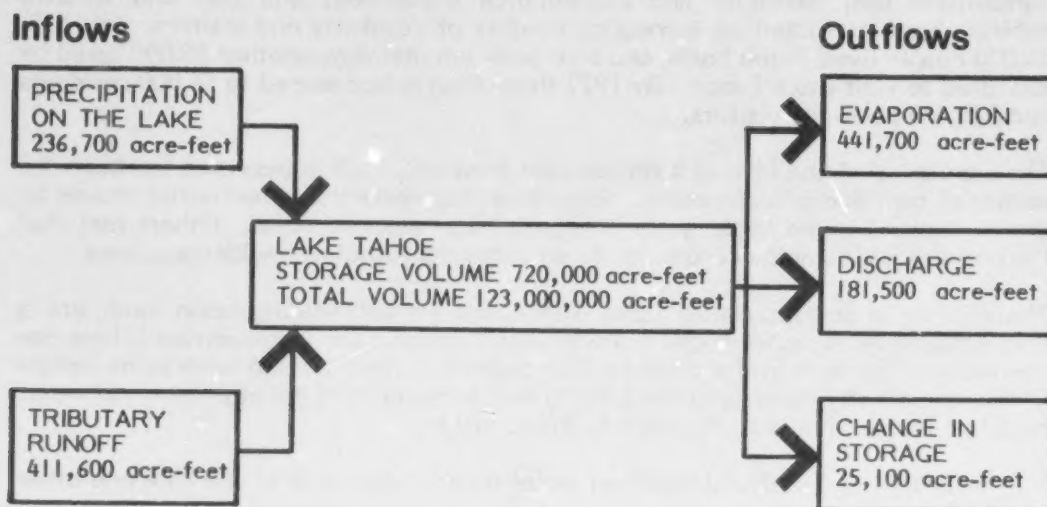


Figure 6 MEAN ANNUAL HYDROLOGIC BUDGET FOR LAKE TAHOE (1960-1974)

Because of geologic conditions, the groundwater level in the Lake Tahoe Basin is closely related to the level of water in the lake. In the south shore area, the safe yield of the groundwater basin has not been determined, but is considered substantial. A gradient exists toward Lake Tahoe, and groundwater levels in the south shore have been relatively constant over the past 15 years. Although the groundwater basin is interspersed with claylens, the water-bearing capacity of the basin is excellent.

Floods around the Lake Tahoe have been scattered and of limited extent. Because of the Tahoe City control dam, there is little danger to shoreline communities from lake flooding. However, localized flooding and damage are an increasing danger because of continuing residential and commercial development. During droughts the lake level drops by as much as 10 feet, but in dry years, the great difference in the volume of the lake and the hydraulic capacity of the Truckee River has a buffering effect, and releases are usually normal or near normal. During the recent drought of 1976-1977 storage volume was reduced by 590,000 acre-feet, gravity flow from Lake Tahoe ceased, and western Nevada discharge requirements were met using pumps to lift the water from the lake to the outlet at Tahoe City. Continued drought would have curtailed releases down the Truckee River, and agricultural areas of western Nevada would have been adversely affected.

2. WATER QUALITY: EXISTING CONDITIONS

The beneficial uses of the lake, which include water supply for municipal and agricultural use, aesthetic and recreational enjoyment, and fish and wildlife habitat, have attracted an increasing number of residents and visitors. In 1970, 34,000 people lived in the basin, and on a peak summer day, another 98,000 could be expected to visit Lake Tahoe. By 1977 these figures had soared to 56,000 residents and 229,000 peak-day visitors.

The popularity of the lake as both a resort area and a wilderness area has been the source of continuous controversy. Some feel that recreational activities should be greatly expanded and made accessible to all who want to come. Others feel that the basin should remain predominantly an undeveloped natural wilderness area.

There is no uncertainty that Lake Tahoe and its surrounding basin lands are a unique resource of regional and national significance. The key question is how can the various interests in the basin be best balanced. This section lends some insight to this question by describing the relationship between land development and water quality. The section is organized into three parts:

- definition of beneficial uses and water quality standards of the lake and other basin waters
- description of present water quality conditions
- discussion of the effects of intensive urbanization.

BENEFICIAL USES AND WATER QUALITY STANDARDS

Lake Tahoe and Interstate Waters

To preserve the remarkable quality of the lake, both California and Nevada have imposed water quality standards over the years. The first standards were adopted pursuant to state authority to fulfill the requirements of the Federal Water Pollution Control Act of 1965, which required each state to prepare water quality standards for all interstate waters. In 1967 California adopted an implementation plan for the Lake Tahoe Water Quality Control Policy that it had established in 1966. In the same year, Nevada's State Board of Health adopted the Interstate Water Quality Standards and Plan of Implementation (1967) for interstate waters of the entire state. Approval of these standards in 1968 and 1969 by the Secretary of the Interior resulted in the adoption of these policies and criteria as both state and federal water quality standards. The intent of these standards is to protect beneficial uses of the lake. The currently designated beneficial uses for California are identified in Table 15; a portion of the current standards are shown in Table 16. The designated beneficial uses for Nevada differ only slightly from those for California and include municipal water, body-contact recreation, fish and wildlife aesthetics, irrigation and stock watering, and power generation. The standards, applying specifically to Lake Tahoe and its tributaries, adopted by Nevada in 1967 and subsequently revised, are shown in Table 17. Nevada's statewide standards also apply.

TABLE 15
BENEFICIAL USES FOR SURFACE AND SUB-SURFACE WATERS IN TAHOE BASIN

Area Code	Hydrologic Unit, Subunit Drainage Feature	Description	Mun	Agr	Ind	Gwr	Rec 1	Rec 2	Warm	Cold	Wild	Sal	Pow	Rare	Frsh	Receiving Water
634.00	LAKE TAHOE HYDROLOGIC UNIT															
634.10	SOUTH TAHOE HYDROLOGIC SUBUNIT															
	LAKE TAHOE	Lake	X	X			X	X		X	X					Truckee River
	HEAVENLY VALLEY CREEK	Perennial Stream	X	X		X	X	X		X	X					Trout Creek
	COLD CREEK	Perennial Stream	X	X		X	X	X		X	X					Trout Creek
	THOUT CREEK	Perennial Stream		X		X	X	X		X	X					Upper Truckee River
	SAXON CREEK	Perennial Stream		X		X	X	X		X	X					Trout Creek
	UPPER TRUCKEE RIVER	Perennial River	X	X		X	X	X		X	X					Lake Tahoe
	ECHO LAKES	Lakes	X				X	X		X	X					Echo Creek
	FALLEN LEAF LAKE	Lake	X				X	X		X	X					Taylor Creek
	TAYLOR CREEK	Perennial Stream		X		X	X	X		X	X					Lake Tahoe
	TALLAC CREEK	Perennial Stream		X		X	X	X		X	X					Lake Tahoe
	TAHOE KEYS	Artificial Bays				X	X	X		X	X					Lake Tahoe
	CASCADE LAKE	Lake	X				X	X		X	X					Cascade Creek
	CASCADE CREEK	Perennial Stream		X		X	X	X		X	X			X		Lake Tahoe
	EAGLE CREEK	Perennial Stream		X		X	X	X		X	X					Lake Tahoe
	o GROUNDWATER		X	X												
	MINOR STREAMS					X		X	X	X		X	X			
634.20	NORTH TAHOE HYDROLOGIC SUBUNIT															
	LONELY GULCH CREEK	Perennial Stream	X	X		X	X	X		X	X					Lake Tahoe
	MECKS CREEK	Perennial Stream		X		X	X	X		X	X					Lake Tahoe
	GENERAL CREEK	Perennial Stream		X		X	X	X		X	X					Lake Tahoe
	McKINNEY CREEK	Perennial Stream		X		X	X	X		X	X					Lake Tahoe
	MADDEN CREEK	Perennial Stream	X			X	X	X		X	X					Lake Tahoe
	BLACKWOOD CREEK	Perennial Stream					X	X		X	X					Lake Tahoe
	WAPD CREEK	Perennial Stream	X			X	X	X		X	X					Lake Tahoe
	BURTON CREEK	Perennial Stream				X	X	X		X	X					Lake Tahoe
	GRIFF CREEK	Perennial Stream				X	X	X		X	X					Lake Tahoe
	DOLLAR CREEK	Perennial Stream		X		X	X	X		X	X					Lake Tahoe
	WATSON CREEK	Perennial Stream				X	X	X		X	X					Lake Tahoe
	CARNELIAN CREEK	Perennial Stream		X		X	X	X		X	X					Lake Tahoe
	o SPRINGS		X	X		X	X	X		X	X					South Tahoe Groundwater
	o GROUNDWATER		X	X											X	
	MINOR STREAMS			X		X	X	X		X	X					

LEGEND:

Mun: municipal and domestic supply
 Agr: agricultural supply
 Ind: industrial service supply
 Pow: hydropower generation
 Gwr: groundwater recharge
 Frsh: freshwater replenishment for inland lakes and streams

Rec-1: water contact recreation
 Rec-2: non-water contact recreation, including esthetic enjoyment
 Warm: warm freshwater habitat to sustain aquatic resources
 Cold: cold freshwater habitat to sustain aquatic resources
 Wild: wildlife habitat
 Rare: preservation of rare and endangered species
 Sal: saline water habitat

Source: California State Water Resources Control Board, Water Quality Control Plan Report, North Lahontan Basin (6A), 1975.

TABLE 16
CHEMICAL WATER QUALITY OBJECTIVES FOR SURFACE WATERS
OF THE NORTH LAHONTAN BASIN

Surface Water	Constituent ¹ (mg/l except as noted)						
	TFR ²	Cl	SO ₄	Na(%)	B	Total N	Total P
<u>Lake Tahoe Hydrographic Unit</u>							
Lake Tahoe ³	60.65	3/4	1.0/2.0	-/-	0.01/-	0.15/0.25	0.008/0.020
Fallen Leaf Lake	50/-	0.30/0.50	1.3/1.4	-/-	0.01/0.02	0.20/-	0.005/0.010
Griff Creek	80/-	0.40/-	-/-	-/-	-/-	0.24/-	0.020/-
Carnelian Bay Creek	80/-	0.40/-	-/-	-/-	-/-	0.21/-	0.010/-
Watson Creek	80/-	0.35/-	-/-	-/-	-/-	0.21/-	0.010/0.020
Dollar Creek	80/-	0.30/-	-/-	-/-	-/-	0.16/-	0.010/-
Burton Creek	90/-	0.30/-	-/-	-/-	-/-	0.10/0.15	0.008/0.014
Ward Creek	70/85	0.30/0.50	1.4/2.8	-/-	-/-	0.25/0.35	0.020/0.030
Blackwood Creek	70/90	0.30/-	-/-	-/-	-/-	0.20/-	0.020/0.030
Madden Creek	60/-	0.10/0.20	-/-	-/-	-/-	0.20/0.25	0.010/0.020
McKinney Creek	55/-	0.40/0.50	-/-	-/-	-/-	0.25/-	0.010/-
General Creek	50/90	1.0/1.5	0.4/0.5	-/-	-/-	0.19/-	0.010/0.020
Meeks Creek	45/-	0.40/-	-/-	-/-	-/-	0.23/-	0.010/0.020
Lonely Gluch Creek	45/-	0.30/-	-/-	-/-	-/-	0.20/-	0.015/-
Eagle Creek	35/-	0.30/-	-/-	-/-	-/-	0.20/-	0.005/0.008
Cascade Creek	30/-	0.40/-	-/-	-/-	-/-	0.20/-	0.003/0.005
Tallac Creek	60/-	0.40/-	-/-	-/-	-/-	0.20/-	0.003/0.004
Taylor Creek	35/-	0.40/0.50	-/-	-/-	-/-	0.20/0.30	0.005/0.010
Upper Truckee River	55/75	4.0/5.5	1.0/2.0	-/-	-/-	0.18/0.24	0.015/0.030
Trout Creek	50/60	0.15/0.20	-/-	-/-	-/-	0.20/-	0.020/0.030

¹ Annual average value/90th percentile value.

² Total filterable residue (total dissolved solids).

³ In addition, the following water quality objectives apply specifically to Lake Tahoe:

- Algal Growth Potential--Mean annual algal growth potential at any point in the Lake shall not be greater than twice the mean annual algal growth potential at the limnetic reference station.
- Plankton Count--The mean seasonal concentration of plankton organisms shall not be greater than 100 per ml and the maximum concentration shall not be greater than 500 per ml at any point in the Lake.
- Clarity--The vertical extinction coefficient shall be less than 0.08 per meter when measured below the first meter. The turbidity shall not exceed 3 JTU at any location in the Lake too shallow to determine a reliable extinction coefficient.
- Electrical Conductivity--The mean annual electrical conductivity shall not exceed 90 μ mhos/cm at 50°C and the 90 percentile value shall not exceed 100 μ mhos/cm at 25°C at any location in the Lake.
- Additional Biological Indicators--The biomass of phytoplankton, zooplankton, and periphyton shall not be increased beyond ambient levels.

Source: California State Water Resources Control Board, Water Quality Control Plan Report, North Lahontan Basin (6A), 1975.

TABLE 17

NEVADA WATER QUALITY STANDARDS
LAKE TAHOE

Control Point

Existing sampling points

pH Units

Single value - Within range 7.0-8.4

Dissolved Oxygen--% of Saturation

Single value - Not Less than 90

Chlorides--mg/l

Single value - Not more than 5

Annual average - Not more than 3

Soluble Phosphorus- $\mu\text{g/l}$

Annual average - Not more than 7

Total Soluble Inorganic Nitrogen-- $\mu\text{g/l}$

Annual average - Not more than 25

Coliform Organisms--MPN/100 ml

A density not greater than the values shown in the following tabulation:

	Median	Maximum
Undeveloped Lake Front Areas		
10 yards offshore	5	32
100 yards offshore	3	15
Developed Lake Front Area		
10 yards offshore	240	700
100 yards offshore	15	64
Directly Influenced by Stream		
10 yards offshore	240	700
100 yards offshore	32	240

Temperature, $^{\circ}\text{C}$

Permissible temperature increase above natural receiving water temperature--None.

Algal Growth Potential--the mean algal growth potential at any point in the lake shall not be greater than twice the mean annual algal growth potential at a limnetic reference station and using analytical methods determined jointly with the Environmental Protection Agency, Region IX.

Plankton Count--number per ml

Average (June through September) - Not to exceed 100

Single value - Not to exceed 500

Specific Electrical Conductance 0 micromhos per cm at 20 $^{\circ}$

Annual average - Not to exceed 95

Single value - Not to exceed 105

Clarity--the vertical extinction coefficient of less than 0.08 per meter when measured at any depth below the first meter, and a turbidity less than 3 Jackson Units at any point of the Lake too shallow to determine a reliable extinction coefficient.

Turbidity--in order to minimize turbidity levels in the Lake and tributary streams and control erosion:

1. The discharge of solid or liquid waste materials including soil, silt, clay, sand, and other organic and earthen materials to Lake Tahoe or any tributary thereto, is prohibited.
2. The discharge of solid or liquid waste materials including soil, silt, clay, sand, and other organic and earthen materials to lands below the high water rim of Lake Tahoe or along any tributary to Lake Tahoe in a manner which will cause the discharge of such waste materials to Lake Tahoe or any tributary thereto, is prohibited.
3. The placement or man-made disturbance of material below the high water rim of Lake Tahoe or along any tributaries to Lake Tahoe, in a manner which will cause the discharge of solid or liquid waste materials including soil, silt, clay, sand, and other organic and earthen materials to Lake Tahoe or any tributary thereto, is prohibited.

Sources: Nevada Department of Conservation and Natural Resources, Division of Environmental Protection, Water Protection, Water Pollution Control Regulations, January 1979.

Intrastate Waters

Section 303 of the 1972 Amendments to the Federal Water Pollution Control Act requires each state to submit to the U.S. EPA all new or revised water quality standards for interstate, intrastate, and coastal waters and to implement a continuing water quality planning process that includes the development of basin plans, schedules for compliance with the standards, and an enforcement procedure. Prior to this federal mandate, California had enacted the Porter-Cologne Water Quality Control Act in 1969, which essentially required the state to undertake the same types of activities--preparation of water quality control plans and standards aimed at protecting beneficial uses of all state waters. The State Water Resources Control Board (SWRCB), through its local arm, the Lahontan Regional Water Quality Control Board (RWQCB) adopted a basin plan in 1975. Among its other duties, the Lahontan RWQCB regulates the discharge of wastewater through the permit procedure under the National Pollutant Discharge Elimination System (NPDES), oversees sewage export systems required by the Porter-Cologne Act, and regulates discharge of surface runoff through issuance of discharge requirements, also provided for under the Porter-Cologne Act. The beneficial uses identified for Lake Tahoe Basin intrastate waters and the standards adopted to maintain those uses shown in Tables 15 and 16.

In Nevada the Commission of Environmental Protection adopted water quality standards for intrastate waters in 1972. A set of standards acceptable to both EPA and the Nevada Environmental Commission (formerly the Commission of Environmental Protection) was approved in 1973. The Nevada Division of Environmental Protection was established as the state agency for management of water quality and to enforce the rules and regulations adopted by the Environmental Commission, pursuant to the Nevada Water Pollution Control Regulations, NRS 445. The agency is also responsible for administering the NPDES program. Because of insufficient data, none of the Nevada waters in the Lake Tahoe Basin that are tributary to Lake Tahoe have individually designated beneficial uses or assigned individual water quality standards.

In both California and Nevada, for tributaries where there are no specific designations, the criteria governing beneficial uses and water quality objectives are those of the water body into which the tributary discharges and for which criteria have been adopted. Thus, in many cases in the basin, the controlling criteria for these tributaries are the same as those for Lake Tahoe. In addition, both states have adopted standards that apply to all state waters. These standards establish acceptable levels of water quality with respect to color, tastes and odors, flooding materials, suspended and settleable materials, oil and grease, toxicity, temperature, pesticides, and radioactivity. (For greater detail, refer to California State Water Resources Control Board, 1975 and Nevada Division of Environmental Protection, 1979.)

Other Significant Policies

A number of other policies have been issued by federal, state and local agencies that apply to the Lake Tahoe Basin. Most significant for protection of Lake Tahoe water quality was the decision to export sewage from the Lake Tahoe Basin. Concern over diminishing clarity of the water and accelerating algal growth

prompted Governors Edmund G. Brown of California and Grant Sawyer of Nevada to issue a joint statement on Lake Tahoe in 1965 that declared the preservation of the beauty of the lake to be the most important responsibility shared by the states. California adopted a Water Control Policy for Lake Tahoe in 1966 that prohibited disposal of waste to surface waters and promoted systems for export of all solid and liquid wastes in 1969. California added Section 13951 to the State Water Code which required export of sewage effluent and prohibited the further maintenance or use of cesspools, septic tanks, or other means of waste disposal in the Lake Tahoe Basin after 1972. Nevada took similar action in January 1971 when Nevada Governor Mike O'Callaghan issued an Executive Order prohibiting use of septic tanks in the Lake Tahoe Basin after 1972 and requiring export of sewage.

Two more significant policies are the Western Federal Regional Council Policy and the nondegradation statements by California and Nevada. In 1978 the Western Federal Regional Council, composed of eleven federal agencies, adopted a policy calling for integration and coordination of all federal activities and programs in the basin in order to ensure reasonable use of the land, air, water, and related resources. The premise behind the policy is that the basin is a unique scenic and recreational resource and should be preserved through the establishment of environmental threshold standards.

The nondegradation policies seek to maintain the water quality of a water body when the quality is higher than called for in the adopted policies. In California, Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California," requires that such existing high quality will be maintained until it has been demonstrated that any change will be consistent with maximum benefit to the state, will not unreasonably affect present and anticipated beneficial use, and will not result in water quality prescribed in the policies. The Nevada policy is similar and was first expressed in 1967 in the Interstate Water Quality Standards and Plan of Implementation. It called for the perpetual maintenance of water quality where waters were to be of high or suitable quality.

WATER QUALITY CONDITIONS

Lake Tahoe

Lake Tahoe is one of the cleanest, clearest freshwater lakes in the world. Its remarkable clarity has been measured through the use of Secchi disks, which are white plates, 20 cm in diameter. These disks are submerged into the water, and the depth at which they can no longer be seen provides an indication of lake clarity. In Lake Tahoe, depth measurements of up to 136 feet have been recorded. In contrast, an eutrophic lake with a heavy algal bloom may have a Secchi disk reading of 5 feet or less.

The absence of algae and sediment are primary reasons for the lake's clarity. In fact, the rate of algal growth in the lake, also known as the primary productivity, (measured by the Tahoe Research Group of U.C. Davis) is so low that it is only slightly higher than that of the permanently frozen Lake Vanda in Antarctica. The reason for the low algae production is that the lake is oligotrophic; that is, it contains few foods (nutrients) for the algae to feed on. Because the lake is oligotrophic, nutrient loading is the primary concern for the preservation of the

lake ecology. Of the foods necessary for algal growth, nitrogen, particularly in the form of nitrate, is the limiting factor: of all the nutrients, minute additions of nitrate to the water body can most enhance the rate of algal growth. (Addition of nutrients in combination stimulates even greater growth rates.)

Table 18 summarizes some of the findings on water quality by a number of researchers using various monitoring techniques and sampling stations. Compared to the standards reported in Tables 16 and 17, lake quality is generally excellent in terms of chemical and physical parameters. However, biological parameters have exceeded the objectives. (Numerous violations of the algal count standard were recorded in 1972 and 1973.) It is difficult to document current instances where water quality measurements exceed the objective because lake conditions are not presently being monitored. Water quality standards are expressed in terms of annual averages, so that a short-term monitoring program of less than a year's duration would be insufficient to demonstrate violation of any standard. Furthermore, some biological standards are defined with the lake center as a reference point. Thus, measurements of algal growth potential or phytoplankton biomass, for examples, at any point in the lake must be compared to similar measurements at the lake center. Although it may be difficult to cite violations of specific standards, it is clear that continued algal growth, as discussed later, would adversely affect the high quality of the waters and may interfere with beneficial uses.

Groundwater

Groundwater quality in both the south and north Tahoe Valley groundwater basins, is excellent, although occasional high concentrations of boron, fluoride, and other minerals have been detected at various locations. The South Tahoe Valley groundwater basin, which occupies the study area portion of the basin, is characterized by low concentrations of total dissolved solids, individual constituents, and total hardness. The water is highly desirable as a source for domestic supplies as well as any other proposed use (Scott, et al., 1978). Table 19 presents water quality characteristics of groundwater in the Lake Tahoe Basin.

Tributaries

Tributary water quality varies depending on the intensity of development in the watershed. Tributaries draining developed areas have higher concentrations of chemical constituents and nutrients than tributaries draining undeveloped areas. (See Table 20.) The differences between developed and undeveloped areas are substantial for suspended solids, turbidity, phosphorus, iron, chlorides, and algal growth potential. Tributaries in the study area are identified in Table 21 along with their quality measurements. By comparing these measurements with the standards approved in the basin plan (see Table 16), it can be said that water quality occasionally exceeds the objectives for total nitrogen and phosphorus. However, it cannot be claimed that a violation has occurred unless the contributing source has caused the annual average or the 90 percentile (whenever appropriate) concentration of the water body to be beyond the limit expressed in the standard.

TABLE 18
WATER QUALITY DATA LAKE TAHOE

Parameter	Lahontan Basin Plan ¹			Joint Study ²		Lake Tahoe Area Council ³		Goldman ⁴ (EPA)
	(nr. Tahoe City, 1965-1968)	(Lake Center South, 1965-1971)	(Lake Center, 1968-1974)	(mid-lake and shore, 1967-1970)	(Lake Center, 1968-1974)	(mid-lake and shore, 1967-1970)	(Lake Center, 1968-1974)	
	n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$	n	
pH	12	7.40	31	7.55	22	7.6	73	7.3 - 8.0
D.O. (mg/l)	11	9.1	33	8.9	22	8.8	--	6.85 - 11.57
Cl (mg/l)	11	2.5	26	2.1	22	2.0	76	1.7 - 2.1
EC @ 25°C	15	99	17	90	22	91	76	$\bar{x}$ 92
Turbidity	18	2.1	14	0.3	22	.2 (tu)	--	--
Kjeldahl (mg/l) = NH ₃ + org - N	10	.15	26	.11	22	.1	68	.052
Nitrate	10	3	15	2	22	2.5	68	$\bar{x}$ 13
Total P (mg/l)	10	3	26	6	22	7.1	75	$\bar{x}$ 13
Total Coliforms (MPN/100ml)	20	1.25	31	1.0	--	--	--	--

n - number of data values
 $\bar{x}$ - mean concentration

¹ California State Water Resources Control Board, Water Quality Control Plan Report, North Lahontan Basin (6A), 1975.

² California Department of Water Resources, Central District, California - Nevada Federal Joint Water Quality Investigation of Lake Tahoe, Ninth Annual Summary - 1974, June 1975.

³ Lake Tahoe Area Council, Eutrophication of Surface Waters - Lake Tahoe, EPA - 16010 DNY 07/71, 1971.

⁴ Goldman, Charles R., "Trophic Status and Nutrient Loading for Lake Tahoe, California-Nevada," North American Project - A Study of U.S. Water Bodies, EPA 600/3-77-086, July 1977.

TABLE 19
GROUNDWATER QUALITY: LAKE TAHOE BASIN

South Tahoe Valley Groundwater Basin

Parameter	Units	Value			Number of Samples	Years of Record
		Mean	Max	Min		
pH	--	7.20	8.10	6.30	24	65-70
As	$\mu\text{g/l}$	--	--	--	0	65-70
Fe	mg/l	--	--	--	0	65-70
Na	mg/l	6.4	8.1	5.1	17	65-70
Na	%	29	43	21	10	65-70
Cl	mg/l	2.1	7.8	0.5	24	65-70
B	$\mu\text{g/l}$	0	0	0	3	65-70
SO ₄	mg/l	3	4	2	3	65-70
TDS	mg/l	61	74	42	3	65-70
EC @ 25°C	$\mu\text{mhos/cm}$	98	176	55	24	65-70
Hardness	mg/l as CaCO ₃	34	68	15	24	65-70

North Tahoe Valley Groundwater Basin

Parameter	Units	Value			Number of Samples	Years of Record
		Mean	Max	Min		
pH	--	7.02	8.40	4.50	28	65-70
As	$\mu\text{g/l}$	0	0	0	3	65-70
Fe	mg/l	--	--	--	0	65-70
Na	mg/l	6.0	12.0	2.1	20	65-70
Na	%	17	30	11	10	65-70
Cl	mg/l	2.8	8.7	0	30	65-70
B	$\mu\text{g/l}$	--	--	--	0	65-70
SO ₄	mg/l	--	--	--	0	65-70
TDS	mg/l	--	--	--	0	65-70
EC @ 25°C	$\mu\text{mhos/cm}$	161	282	41	30	65-70
Hardness	mg/l as Ca CO ₃	65	123	16	30	65-70

Sources: California State Water Resources Control Board, 1975.

TABLE 20
MEAN QUALITY OF TRIBUTARY STREAMS

<u>Parameters</u>	<u>Disturbed</u> ¹	<u>Undisturbed</u> ²
Dissolved Oxygen (mg/l)	9.7	9.6
Dissolved Oxygen (% Saturation)	98	100
pH	7.3	7.1
Suspended Solids (mg/l)	8	4
Turbidity (JTU)	5	0.5
Nitrate-N ($\mu\text{g/l}$)	47	30
Total Nitrogen ($\mu\text{g/l}$)	300	252
Total Phosphorus ($\mu\text{g/l}$)	29	15
Total Iron ($\mu\text{g/l}$)	97	45
Chlorides (mg/l)	1.2	0.5
Algal Growth Potential ($\mu\text{g/l}$)	0.5	0.05

¹Physical, chemical, and biological data from 21 tributaries draining watersheds which have been subdivided or otherwise developed. The 21 tributaries are:

California

Tahoe State Park
Burton
Tahoe Vista
Griff Creek
Trout Creek
Upper Truckee
Tallac Creek
McKinney Creek
Blackwood Creek
Ward Creek

Nevada

First Creek
Second Creek
Rose Knob
Third Creek
Incline Creek
Millcreek
Glenbrook Creek
Logan House Creek
McFaul Creek
Burke Creek
Edgewood Creek

²Physical, chemical, and biological data from 15 tributaries draining natural, undeveloped watersheds. The 15 tributaries are:

California

Dollar
Watson
Carnelian Bay Creek
Taylor Creek
Cascade Creek
Eagle Creek
Meeks Creek
General Creek
Madden Creek

Nevada

Tunnel Creek
Marlette Creek
Secret Harbor Creek
Bliss Creek
Slaughter House Creek
Zephyr Creek

Source: Adopted from Tahoe Regional Planning Agency, Lake Tahoe Basin Water Quality Management Plan, Vols. I and III, 1977.

TABLE 21
SIZE AND WATER QUALITY OF TRIBUTARIES¹

Watershed	No. (acres)	Area Acres	Runoff ⁴ Feet	D.O. mg/l	D.O. % Sat.	pH	SS mg/l	Turb. JTU	NO ₃ -N mg/l	Total N mg/l	Total P mg/l	Total Fe mg/l	Chlorides mg/l						
DCSID																			
Deadman Point	27	654	252																
Slaughter House Creek	28	4,632	2,797	9.5	9	7.4	12	5.0	4	94.2	13	557.1	13	19.5	13	124.3	4	0.96	4
										55.0	4	27.7	4	27.7	4				
Glenbrook Creek	29	3,309	2,608	10.0	5	7.4	7	8.2	3	68.3	8	281.7	8	29.1	8	113.3	7	2.19	2
										83.5	11	50.6	11	50.6	11				
North Logan House Creek	30	1,053	649																
Logan House Creek	31	1,542	1,207	10.5	9	7.4	13	2.6	5	33.4	14	252.5	14	28.1	14			0.82	5
Cave Rock	32	1,018	394																
Lincoln Creek	33	1,600	988																
Skyland	34	483	264																
North Zephyr Creek	35	1,662	1,150																
Zephyr Creek	36	1,106	813							9.3	7			7.3	6				
South Zephyr Creek (included in #36)	37																		
McFaul Creek	38	2,622	1,659	10.0	9	7.4	9			33.0	9	302.9	9	24.8	9				
Burke Creek	39	3,317	2,243							33.0	1	9.2	1	9.2	1				
Edgewood Creek	40	3,494	4,683	6.1	5	7.8	5	4.3	5	30.2	5	260.1	5	101.0	5			2.60	5
				10.1	9	7.3	13	6.8	5	52.4	14	303.9	14	33.9	14			1.79	5
										26.7	10	14.8	10	14.8	10	43.5	2		
STPUD																			
Bijou Park	41	2,662	2,670																
Bijou Creek	42	1,872	1,787																
Trout Creek	43	25,549	36,378	9.1	7	7.1	7	2.8	7	42.6	7	230.3	7	50.3	7	22.3	36	147.9	11
										55.2	35								
Upper Truckee	44	35,475	93,106	9.0	14	7.1	14	2.0	14	30.3	22	181.3	22	21.1	22	16.5	53	121.3	12
										49.9	52								
Camp Richardson	45	2,058	2,696																
Taylor Creek	46	11,736	34,257	8.8	14	7.0	14	0.5	14	12.7	21	142.1	21	6.9	21			0.6	21
				9.7	9	6.9	13	0.7	5	22.7	14	209.9	14	11.8	14			0.45	5
										22.0	48	10.6	48	10.6	48	18.3	11		
Tallac Creek	47	2,781	6,200	10.7	9	7.1	13	7.3	5	29.7	14	218.4	14	17.5	14	17.5	14	0.37	3
										33.8	8	13.3	3	13.3	3	76.7	3		
Cascade Creek	48	3,075	10,052	9.9	9	6.7	10	0.9	3	20.3	12	215.0	12	8.6	12	3.2	17	11.4	5
										11.3	17								
Eagle Creek	49	5,406	18,975	10.4	9	6.7	13	3.7	5	39.4	14	198.1	14	9.8	14			0.32	5

¹Adapted from Tables I-4 and B-1 in Lake Tahoe Basin Water Quality Management Plan, Vol. III (TRPA, 1977b).

²Mean concentration

³Number of data values

⁴Calculated mean annual runoff

EFFECTS OF URBANIZATION

Sedimentation and eutrophication are part of the life cycle of every lake. Sedimentation is the deposition of solid particles and other matter that have been dislodged through erosion. Eutrophication is the process whereby lakes become enriched with nutrients and organic matter that result in water quality characteristics undesirable for man's use of the water. This process occurs most rapidly in shallow lakes that receive large amounts of nutrients. An eutrophic lake is characterized by a large quantity of planktonic algae, low water transparency, high dissolved oxygen in the upper layer, zero dissolved oxygen in deep layers during summer months, and large organic deposits. Because Lake Tahoe is so deep and the nutrient loading is minimal, its eutrophication would normally be extremely slow. However, urbanization has greatly accelerated both eutrophication and sedimentation.

The pollutants of greatest concern are nutrients (nitrogen, phosphorus, and iron); suspended and settleable solids; and oil and grease. Excessive quantities of nutrients induce algal growth. Dense algal blooms, aesthetically unattractive, cause turbidity and reduce levels of dissolved oxygen as they decompose. Inert suspended and settleable solids reduce light penetration in the lake and consequently inhibit photosynthesis. Solids settling to the bottom of a water body may smother bottom organisms and disturb reproduction habitats for fish. Organic solids create an oxygen demand which depletes the supply of available dissolved oxygen. Oil and grease form a thin, unaesthetic film on the water surface, which can reduce the rate of reoxygenation (the process of resupplying a water body with dissolved oxygen).

Essentially, sedimentation and eutrophication are accelerated when development occurs on land that is susceptible to erosion and in areas that would otherwise have a natural capability to remove pollutants being transported by surface runoff.

Loss of Environmentally Sensitive Lands

As pressures to meet housing and recreation demand have increased in the Lake Tahoe Basin, land disturbance has occurred in environmentally sensitive areas. In particular, two areas have been affected: high erosion hazard lands and stream environment zones (SEZ).

High Erosion Hazard Lands. High erosion hazard lands include soils and landforms with high disturbance characteristics such as steep slopes, unvegetated roadways, and eroding drainage ditches. TRPA's land use capability system segregates lands with different hydrological, erosional, and vegetational conditions into classes on a scale of 1 to 7. High erosion hazard lands are classified 1a, 1c, and 2, lands that cannot tolerate human disturbance without interfering with erosional rates and hydrological conditions. A simple empirical formula, derived by the SWRCB, shows a close relationship between suspended solids production, land capability, and amount of land disturbed. Based on an evaluation of nineteen watersheds with well-developed estimates of annual suspended sediment production and an estimate from a totally impervious area, the formula predicts erosion rates within a reasonable range of accuracy ($R=0.69$, percent significance = 95%). SWRCB estimates that 60 percent of all sediment production in the basin is a direct

result of urbanization. Sediment yield is greatest from unvegetated and oversteepened areas adjacent to buildings and roadways, particularly on high erosion hazard lands (SWRCB, n.d.). Table 22 shows the amount of vacant land in the study area that is classified Ia, Ic, or 2.

TABLE 22
VACANT LAND IN HIGH EROSION HAZARD LANDS¹

Land Use District	Total Zoned Vacant Land (acres) (1)	Total Zoned Vacant Land High Erosion in Hazard Lands (acres) (2)	Percentage (Col. 2 ÷ Col. 1 × 100) (3)
STPUD			
Residential	2500.0	611	24.4
General Commercial	403.7	41	10.2
Tourist Commercial	200.6	23	11.5
DCSID			
Residential	1177.0	552	46.9
General Commercial	76.8	10.9	14.2
Tourist Commercial	93.0	16.7	18.0

¹ Figures derived by Sedway/Cooke using CTRPA 1978 Land Use Maps and TRPA 1977 Land Use Maps.

In addition to the above sources of potential erosion, a number of other specific problem areas contribute to erosion. Table 23 shows the location by watershed of some of these other sources, including unvegetated roadway slopes, oversteep roadway slopes, areas stripped of vegetation, inadequate or unstable drainage systems, eroding roadway shoulders and ditches, and eroding dirt roads. The Upper Truckee River, Burke Creek, and Edgewood Creek watersheds are critical areas where sediment yield may have severe impacts.

Tables 22 and 23 give an estimate of erosion potential but no indication of how seriously these problem areas can affect water quality. To do this, TRPA, as part of its water quality managing process, measured runoff quality from these areas. Table 24 shows the runoff quality to be significantly lower than the quality presently in the lake.

The potential for water quality degradation from land disturbance is great. In the DCSID area, especially, a large proportion of the remaining vacant zoned land is in high erosion hazard areas. Intensive development in high erosion hazard lands without proper site development precautions would undoubtedly and adversely affect the beneficial uses of waters in the Lake Tahoe Basin. (For an example of the importance of good site planning and construction management practices, refer to the California SWRCB Demonstration of Erosion and Sediment Control Technology, 1978. In that project, the development and construction of a subdivision using extremely poor development practices resulted in an estimated

TABLE 23
EROSION AND DRAINAGE PROBLEM
IDENTIFICATION BY WATERSHED

		Problem Type and Quantity					
#	Watershed Name	Unveg. Roadway Slopes (acres)	Oversteep Roadway Slopes (miles)	Areas Stripped of Vegetation (acres)	Eroding Roadway Shoulders & Ditches (miles)	Inadequate or Unstable Drainage Systems (miles)	Eroding Dirt Roads (acres)
STPUD							
41	Bijou Park	7.41	1.06	--	32.08	10.42	13.73
42	Bijou Creek	--	--	3.21	20.88	4.68	6.23
43	Trout Creek	9.46	4.04	7.48	46.46	9.38	10.98
44	Upper Truckee River	45.22	9.16	59.65	130.70	25.26	35.84
45	Camp Richardson	--	--	--	9.91	2.65	--
46	Taylor Creek	0.92	1.13	--	2.09	0.09	1.38
47	Tallac Creek	1.79	0.31	--	3.37	0.10	6.02
48	Cascade Creek	0.57	0.10	--	1.15	0.02	4.99
	Subtotal	65.37	15.80	70.34	246.64	52.60	79.17
DCSID							
27	Deadman Point	No problem identified					
28	Slaughter House	14.78	1.59	0.69	0.80	0.58	--
29	Glenbrook Creek	20.99	5.54	0.69	1.00	0.12	1.49
30	North Logan House Creek	2.17	0.19	--	0.59	--	10.99
31	Logan House Creek	0.99	0.36	0.11	0.15	0.21	--
32	Cave Rock	7.19	1.34	--	0.64	0.41	0.63
33	Lincoln Creek	7.21	1.80	1.15	2.59	0.98	1.38
34	Skyland	1.12	0.40	--	2.21	0.86	13.89
35	North Zephyr Creek	0.39	0.28	0.40	0.84	0.38	--
36& 37	South Zephyr Creek	3.73	1.84	1.38	2.91	0.93	1.38
38	McFaul Creek	4.09	1.71	1.52	1.69	1.87	2.27
39	Burke Creek	24.73	4.25	18.07	7.58	2.62	8.41
40	Edgewood Creek	47.99	9.66	37.71	9.83	4.09	7.26
	Subtotal	135.38	28.96	61.72	30.83	13.05	47.70
	Total	200.75	44.76	132.06	277.47	65.65	126.87

Sources: Adapted from Tahoe Regional Planning Agency, Lake Tahoe Basin Water Quality Management Plan, Vol. I., pp. VI-6-7, 1977.

10,600 percent increase above the natural background sediment yield and in the loss of aquatic life.)

TABLE 24
COMPARISON OF LAKE TAHOE WATER QUALITY WITH
RUNOFF QUALITY OF EROSION PROBLEM AREAS

	Suspended Solids (mg/l)	Turbidity ¹ (FTU)	Nitrate (mg/l)	Total N(mg/l)	Total P(mg/l)
Lake Tahoe	2.6	0.3	.013	.133	.093
Unpaved parking lots	16,600	1,000	--	9.18	3.45
Bare areas	989	319	.25	4.05	1.68
Unsurfaced roads and driveways	7,780	5,060	.88	2.64	1.21
Dirt roadside ditches	648	175	--	3.24	0.95
Roadway slopes	443	304	.16	0.99	0.67

¹ All values except those for turbidity are taken from TRPA, Lake Tahoe Basin Water Quality Management Plan, Vol. I, 1977. Turbidity values are from the SWRCB's Water Quality Control Plan Report, North Lahontan Basin (6A), 1975.

Stream Environment Zones. SEZs are major and minor streams, intermittent streams and drainageways, meadows, and wetlands, and other areas of water influence. They convey spring snowmelt, stormwater, and other forms of runoff from the hillsides of the basin to the lake, and as runoff moves through these zones, sediment and other pollutants in the runoff are often removed. The natural cleansing capability of SEZs is important to the water quality of the basin. They are also an extremely diverse and valuable biological community. TRPA, as part of its water quality management planning, has identified and mapped these zones and views them as environmentally sensitive areas.

As described earlier, much of the soil of the basin is fragile and easily erodible. Once dislodged, soil particles and attached nutrients can enter the lake, where they diminish clarity and stimulate algal growth. Natural meadowlands offer resistance to waters flowing over them, and thus permit greater deposition of suspended sediments before they enter a water body. The effectiveness of this natural cleansing capability was investigated by the EPA Environmental Monitoring and Support Laboratory (EMSL) (U.S. EPA, 1979). Major findings from field work are that: the efficiency of meadowland treatment was greatest when the concentrations of nutrients and sediments were highest (during rainstorms); treatment effectiveness is reduced by increases in slope and by runoff flow that occurs as channels (rather than sheet flow); meadowland systems are highly variable with respect to nutrient removal and determination of treatment capacity should be evaluated on a system-by-system basis; extensive grazing reduces treatment effectiveness by altering the filtration characteristics; and filtering effectiveness in the functioning meadowlands increased during high flows for sediments, total phosphorus, total Kjeldahl nitrogen, turbidity, and organic carbon.

Only two of the eight systems investigated, Blackwood Road Drainage and to a lesser extent Trout Creek, demonstrated efficient meadowland treatment. The effectiveness of SEZs as treatment processes depends heavily on the individual characteristics of the meadowland, as well as the location and intensity of development. Meadowlands were found, in some instances, to cause an increase in pollutant loading, but these situations were sometimes explained by factors unrelated to the meadowland itself. For example, in one study area, a storm drain collecting runoff from a mobile home park caused high phosphorus readings. The greatest reduction in pollutant loading was observed in the Blackwood Road drainage during the spring, when nitrite and nitrate concentrations were reduced 96 percent. When at least 0.01 inch of rain falls, average percentage reductions of greater than 90 percent were observed for total phosphorus, turbidity, total residue, and total non-filtrable residue.

The amount of vacant land in SEZs is shown in Table 25. The fact that these areas are zoned for urban uses is a serious conflict between land use and environmental quality.

TABLE 25
VACANT LAND IN STREAM ENVIRONMENT ZONES¹

Land Use Districts	Total Zoned Vacant Land (acres) (1)	Total Zoned Vacant Land in SEZs (acres) (lots) (2) (3)		Percentage (Col. 2 ÷ Col. 1 × 100) (4)
STPUD				
Residential	2500.0	1,212	3,627	48.5
General Commercial	403.7	100	172	24.8
Tourist Commercial	200.6	34	64	16.9
Others	N.A.	N.A.	266	N.A.
			4,129	
DCSID				
Residential	1177.0	131	130	11.1
General Commercial	76.8	15.1	1	19.7
Tourist Commercial	93.0	62.5	2	67.2
Others	N.A.	N.A.	165	N.A.
			298	

¹ Sedway/Cooke derived acreage figures using TRPA's land use and stream environment zone maps. Lot figures were derived from TRPA data. Acreage figures for "Others" were not determined. SEZs have been considered to be in land capability land in these sensitive environmental areas, because many SEZs occur on lands in other capability classes.

The implications of urbanization in these areas, which is likely considering nearly half of the vacant residential land in STPUD is located partially or fully in SEZs, are threefold:

- the ability of these zones to convey surface runoff may be restricted

- severe disturbance to valuable fish and wildlife habitats may occur
- a potentially effective natural treatment process may be removed.

Algal Growth

The rate of algal growth (primary productivity) measures the growth of algae and reflects changes in the nutrient content of the lake. Algae are plants of the simplest form, and their basic function is to convert inorganic materials suspended in water into organic matter. Algal growth is a natural process; however, overproduction can produce undesirable odors, scums, and loss of light. Cold clear lakes such as Lake Tahoe tend to support few algae. Techniques commonly used to measure algal growth are not sensitive enough to detect the low levels in Lake Tahoe.

Nutrient concentrations are often used to indicate the "fertility" of a water body. Existing levels in Lake Tahoe comply with standards aimed at preventing aquatic growths that adversely affect beneficial uses. Nevertheless, an unprecedented rate of algal growth has been observed. Between 1958 and 1968, the rate of algal growth rose 1.8 percent per year. Over the next ten-year period, total annual primary productivity increased nearly 7.5 percent per year. This rate of algal growth occurred in spite of the exportation of sewage, the major source of nutrients, since 1968. Past and recent trends are shown in Figure 7.

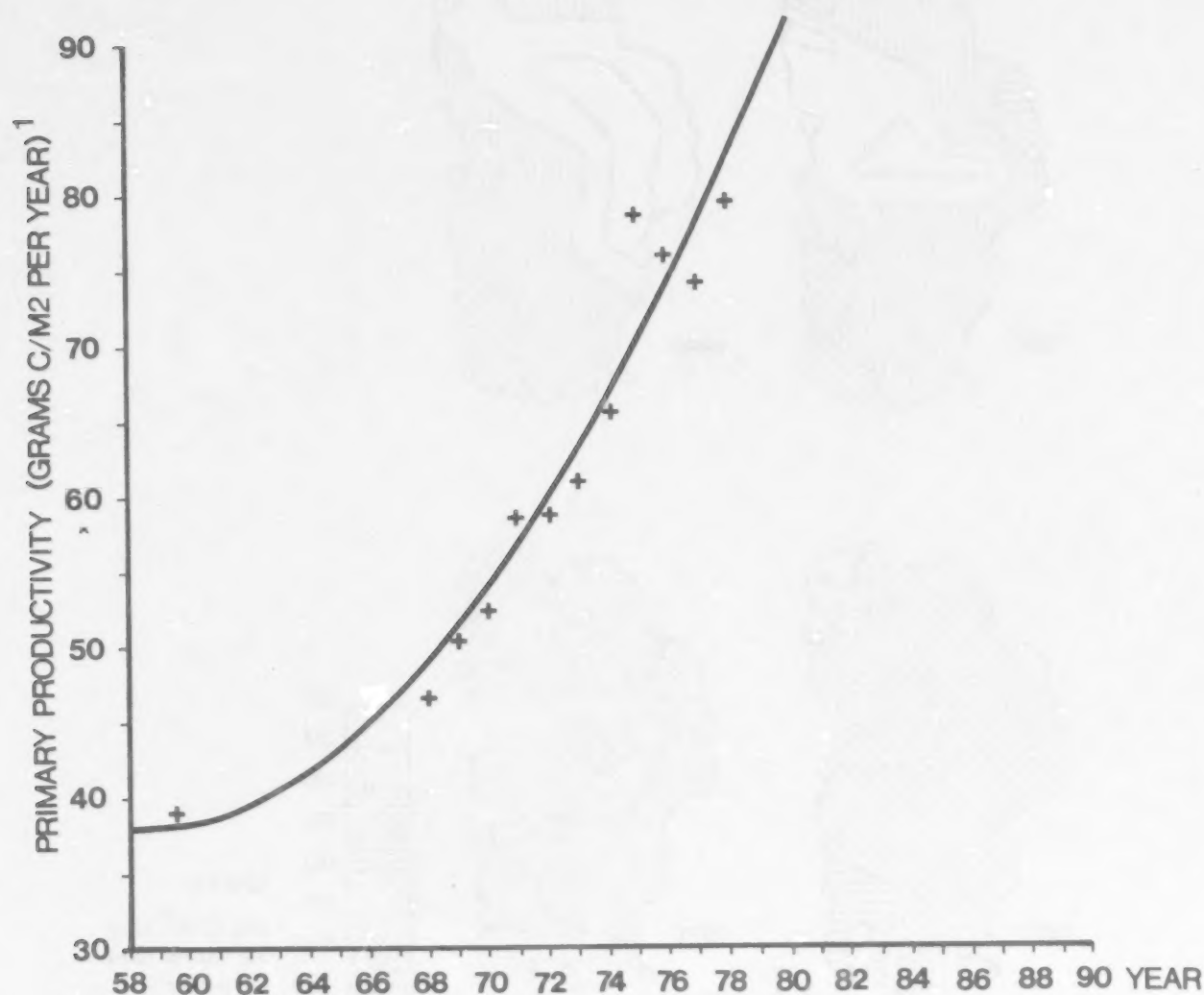
The only factor that can account for the dramatic rise in primary productivity is the increase in nutrient loading to the lake resulting directly from land disturbance. According to studies undertaken to document this relationship, algal growth is greater at the mouths of tributaries draining urbanized watersheds and algal growth stimulating nutrients from land under well-developed conditions was far in excess of those from land under natural conditions. Figure 8 shows changes in algal growth and where the changes occurred between 1968 and 1971. (Goldman, 1974; Goldman and DeAmezaga, 1975 a, b; Sedway/Cooke, 1979; Leonard, in press.)

In conclusion, it becomes apparent as additional information becomes available that man's presence in the Lake Tahoe Basin is having a noticeable effect on lake quality. Continued land disturbance without erosion control measures will result in a steady influx of sediment and nutrients that will, in turn, stimulate algal growth. Both periphyton and phytoplankton communities have become more noticeable, particularly in the near shore areas. Such growths not only detract from the visual appeal of the lake but also from the desire for body-contact recreation--both key beneficial uses of the lake.

Change in Runoff and Lake Quality

As the intensity of land use increases, so does pollutant loading in runoff. Thus, concentrations of pollutants entering the lake would increase if future development plans call for greater residential and commercial land uses. Table 26 shows the concentrations of suspended solids and various nutrients in runoff for each of the different land uses. The table can be summarized as follows:

Figure 7
TOTAL ANNUAL PRIMARY PRODUCTIVITY IN LAKE TAHOE



Measured at Tahoe Research Group Index Station.

¹ grams C/m²/year = grams of carbon assimilated by algae per square meter of Lake Tahoe water per year. The technique of injecting a known amount of ^{14}C into a lake sample, measuring how much is used (assimilated) by algae in a four hour period, and then calculating the consumption of ^{12}C (which is based on the consumption of ^{14}C) is the only one sensitive enough to measure the growth rate of algae in Lake Tahoe

Source: Charles Goldman, Tahoe Research Group, Preliminary Unpublished Data.

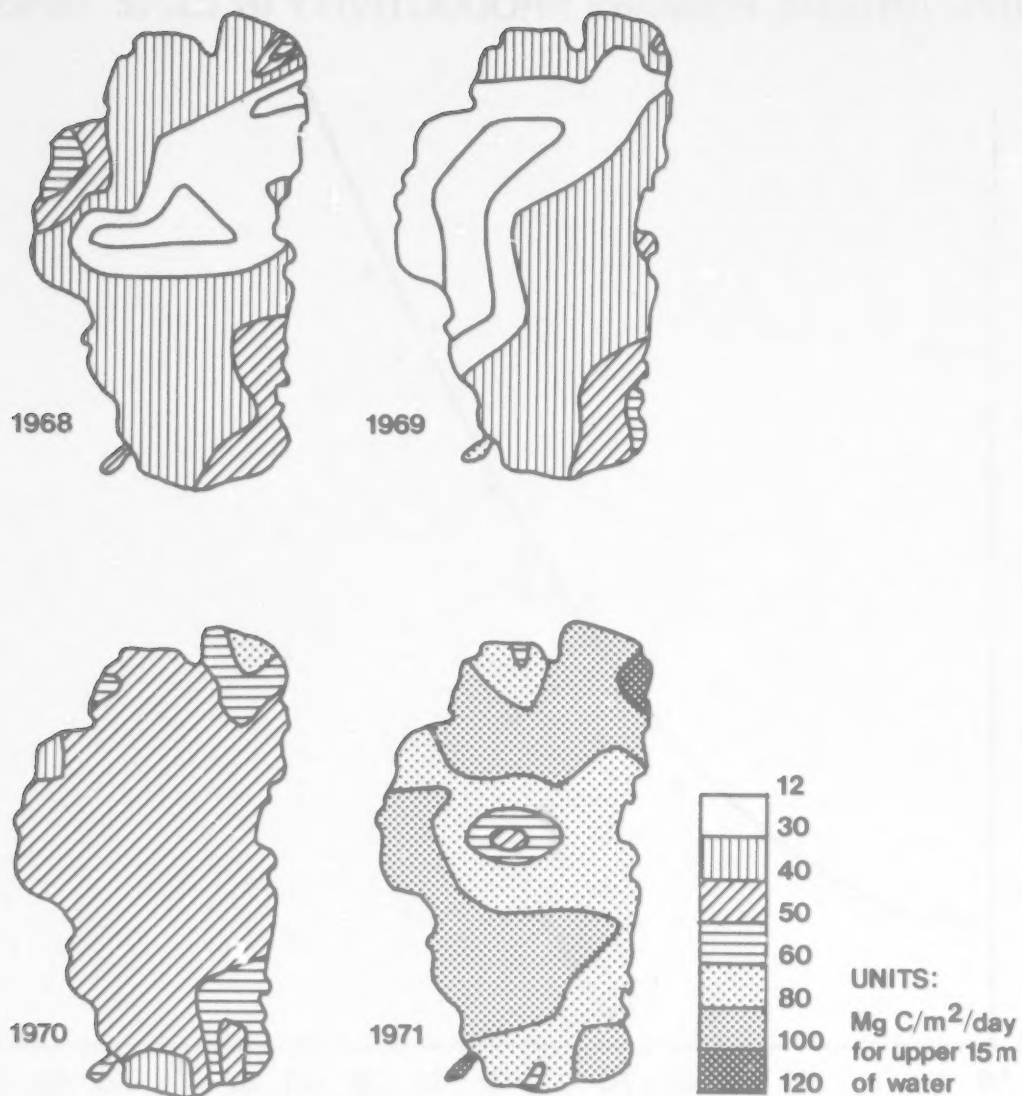


Figure 8
CHANGES IN PRIMARY PRODUCTIVITY: LAKE TAHOE

Source: Charles Goldman and Evelyne de Amezaga, "Spatial and Temporal Changes in the Primary Productivity of Lake Tahoe, California-Nevada between 1959 and 1971," *Verh. Internat. Verin. Limnol.* 19, 812-825.

TABLE 26
ANNUAL NUTRIENT AND SEDIMENT LOADINGS - 1976

Land Use District	Area ¹ in Basin (acres)	Suspended Solids		NO ₃ -Nitrogen	
		Conc. (mg/l)	% of Total Loading (Kg x 10 ⁶)	Conc. (µg/l)	% of Total Loading (gm x 10 ⁶)
LDR	13,311	613	17.77	124	3.59
MDR	1,626	489	1.84	48	0.18
HDR	1,074	249	0.58	82	0.19
RE	2,488	200	0.93	40	0.19
GC	1,123	773	2.45	147	0.47
TC	1,024	4,018	9.58	349	0.82
REC	2,207	48	0.22	55	0.27
PS	727	323	0.58	102	0.18
Subtotal of Developed Lands	23,580		33.95		5.89
CR	--	66	--	28	--
CF	174,538	66	30.06	28	12.75
Total	198,118	--	64.01 x 10 ⁶ Kg	--	18.64 x 10 ⁶ gm

¹ Includes land used for the designated purpose as of May 1976.

Source: Tahoe Regional Planning Agency, Lake Tahoe Basin Water Quality Management Plan, Volume III: Assessment of Water Quality and Environmental Impacts, February 1977.

(Continued, next page)

Land Use District	Area ¹ in Basin (acres)	Total Nitrogen		Total Phosphate		Total Iron	
		Conc. (µg/l)	% of Total Loading ₆ (gm x 10 ⁶)	Conc. (µg/l)	% of Total Loading ₆ (gm x 10 ⁶)	Conc. (µg/l)	% of Total Loading ₆ (gm x 10 ⁶)
LDR	13,311	1,179	34.18	720	20.87	340	9.90
MDR	1,626	547	2.06	470	1.77	363	1.37
HDR	1,074	715	1.68	789	1.85	1,396	3.27
RE	2,488	400	1.85	250	1.16	350	1.62
GC	1,123	1,680	5.33	1,272	4.04	1,067	3.40
TC	1,024	1,255	2.99	848	2.02	4,215	10.05
REC	2,207	599	2.80	377	1.77	540	2.53
PS	727	1,881	3.35	788	1.40	4,321	7.70
Subtotal of Developed Lands	23,580		54.24		34.88		39.84
CR	--	208	--	101	--	346	--
CF	174,538	208	94.72	101	45.99	346	157.56
Total	198,118	--	148.96x10 ⁶ gm	--	80.87x10 ⁶ gm	--	197.40x10 ⁶ gm

¹Includes land use for the designated purpose as of May 1976.

Source: Tahoe Regional Planning Agency, Lake Tahoe Basin Water Quality Management Plan, Volume III: Assessment of Water Quality and Environmental Impacts, February 1977.

- highest concentrations of suspended solids were measured on tourist commercial, general commercial, and low density residential
- highest concentrations of total nitrogen were measured on public service, general commercial, tourist commercial, and low density recreational
- highest concentrations of total phosphate were measured on general commercial, tourist commercial, high density residential, and public service
- for all monitored pollutants, the lowest concentrations were measured on recreation, rural estates, conservation reserve, and general forest lands.

To get a better perspective on the major pollutant sources, one must look not only at the concentrations but also at the loadings from different land uses. The loading refers to the actual amount of pollutant running off the land, based on the concentrations, the runoff volumes, and the area contributing the runoff. For example, runoff from tourist commercial land uses has nitrate concentrations twice those of low density residential. Yet the loading from tourist commercial lands is less than a quarter of that from low density residential--primarily because there is so much more acreage in the latter land use.

The effect that urbanization has had on pollutant loading can be seen by comparing the existing conditions, as presented in Table 26, with what the pollutant loading would be under natural, undeveloped conditions. TRPA assumed general forest lands to be the best available surrogate for undeveloped conditions and based its natural scenario on the assumption that all basin lands were general forest. It determined that the loading of suspended solids from general forest lands would be half that of existing land uses, and loadings of other major pollutants would be between 15 and 40 percent of loadings under existing conditions (see Table 27). However, the TRPA work did not take into account the development that has occurred on general forest lands nor land capability, both of which are significant factors. The SWRCB and a U.C. Davis research both have calculated natural sediment loadings 10 times less than those reported by TRPA. Perhaps most significant, though is the fact that the 208 study measured only dissolved total nitrogen, excluding that portion tied up in the sediment. Thus, the nitrogen loading and impacts of development severely underestimate the total loading.

TABLE 27
COMPARISON OF SURFACE WATER RUNOFF QUALITY
BETWEEN NATURAL AND DEVELOPED CONDITIONS

Watershed Condition	Loadings (grams x 10 ⁺⁶)					
	Suspended Solids (1)	(2)	NO ₃ Nitrogen	Total Nitrogen	Total Phosphate	Iron
Natural	3,100	32,000	14	104	50	170
Existing Land Use (1976)	61,000	64,000	19	149	81	197
Percent Increase	1,868	100	36	46	62	16

Source: Tahoe Regional Planning Agency, Lake Tahoe Basin Water Quality Management Plan, Vol. III, 1977, except column 1 of Suspended Solids which is taken from SWRCB, Sediment yield, n.d.

TABLE 28
POTENTIAL CHANGE IN POLLUTANT CONCENTRATION OF LAKE TAHOE¹

Parameter	Present Concentration	Calculated Concentrations in 10 Years	Calculated Ultimate Concentration	% Increase in 10 Year	% Increase Ultimately
Suspended Solids	2.6mg/l	4.0	5.1	53.8	96.2
Nitrate Nitrogen	13.0 mg/l	13.3	14.9	2.3	14.6
Total Nitrogen	133.0 mg/l	136.0	165.0	2.3	24.1
Total Phosphate	9.3 mg/l	11.0	14.6	18.3	57.0
Total Iron	20.0 mg/l	21.4	23.2	7.0	16.0

¹ Potential change is the change expected over time based on existing (1976) land use patterns. Potential change is based on the equation below.

$$C_t = \frac{W}{BV} (1 - e^{-Bt}) + C_0 e^{-Bt}$$

where:

C_t = pollutant concentration at time, t

C_0 = initial pollutant concentration at time, $t = 0$

W = $Q_R C_R + Q_P C_P$ = annual pollutant loading on the lake,

Q_R = mean annual surface runoff into lake

Q_P = mean annual precipitation on lake surface

C_R = mean concentration of pollutant in runoff

C_P = mean concentration of pollutant in precipitation

$$B = \frac{1}{t_0} + K$$

$t_0 = \frac{V}{Q_D}$ = average pollutant residence time in lake

V = lake volume

Q_D = mean annual discharge from lake

K = rate of pollutant sedimentation

Of particular interest is how these loading rates would affect the pollutant concentrations in the lake. Using a formula that relates changes in pollutant concentrations over time to annual pollutant loadings, average pollutant residence time in the lake, and lake volume, TRPA has determined the effect that the above loading rates would have on the lake. The change from present lake conditions (1976) to future conditions as a result of runoff from existing land uses is seen in Table 28.

3. IMPACT ASSESSMENT

Question: To what extent will development encroach upon high erosion hazard lands?

Measurements

		Growth Scenarios				
	1978	1	2	3	4	5
Vacant residential lands in high erosion hazard areas (acres)						
STPUD	611	The percentage of acres to be developed under each scenario cannot be determined, except under buildout conditions when all vacant land would be developed (Scenarios 2 and 5 for STPUD and Scenarios 4 and 5 for DCSID).				
DCSID	552					
Impact rating		Medium	Medium	High	Extreme	Extreme

High erosion hazard areas are defined as land capability levels 1a, 1c, and 2. It cannot be said with any certainty how much vacant residential high erosion hazard land will be developed. It is assumed that this measure gives some indication of erosion potential; it does not give an indication of actual sediment yield. Furthermore, it does not account for the contribution of capability classes 1b, and 3 through 7.

Description

Development in areas highly susceptible to erosion can adversely affect lake quality by reducing clarity and stimulating algal growths as described earlier under "Effects of Urbanization." Large sediment plumes carrying nutrients have been detected at the mouths of tributaries draining areas undergoing construction and land disturbance. Based on the SWRCB study (n.d.) for class 7 lands, a 1 percent disturbance would cause a sediment yield of 0.035 tonnes/hectare/year; a 10 percent disturbance, 0.2 tonnes; and a 100 percent disturbance, 11 tonnes for a low capability area of 2, a 1 percent disturbance would cause a sediment yield, 25 tonnes/hectare/year; a 10 percent disturbance, 2.1 tonnes; and a 100 percent disturbance, 21 tonnes/year.

In STPUD, the 611 acres of vacant residential land in high erosion hazard areas is only a quarter of the total vacant residential acreage. It is possible for development under Scenarios 1, 3, and 4 to avoid all high erosion hazard lands. However, it is more likely that some development would occur in these sensitive areas; in fact, most development slated for the Tahoe Keys, Bijou Park, Tallac Village, and Meyers would be in high erosion hazard areas.

In DCSID, nearly half of the remaining vacant residential land is in high erosion hazards areas. Areas likely to be developed include Kingsbury Grade and Zephyr Cove, both of which are areas of moderate to high erosion hazard, and adverse impacts can be expected even at low levels of development.

Critical Implications

Intensive development, especially in the DCSID portion of the basin, would create problems of erosion and sedimentation, and would stimulate algal growth in the lake. Quantification of the impacts would require more detailed analyses of the areas to be developed and the effectiveness of existing mitigation measures, but, sediment and nutrient concentrations of runoff could increase dramatically as these areas develop. Severe problems may occur in the Kingsbury Grade area because it is in a watershed that has much of its vacant land in erodible areas.

Question: To what extent will development encroach upon SEZs?

Measurements

	<u>Growth Scenarios</u>				
	1	2	3	4	5
STPUD					
Percent of vacant residential lots in SEZs likely to be developed	19	100	53	19	100
DCSID					
Percent of potential housing units in SEZs likely to be developed	12	12	50	100	100
Impact rating	Medium	High	High	High	Extreme

SEZs are lands classified by TRPA as 1b land use capability. Percentage of vacant residential land in SEZs were derived from data on CTRPA's 1978 land use update and TRPA's land use and stream environment zone maps. In STPUD, there are 3,627 vacant residential lots in SEZs. In DCSID, there are 1,114 housing units on 131 acres in SEZs.

Potential development was allocated to each major traffic zone based on a cursory market analysis and on land use policies implemented by CTRPA, TRPA, and Lahontan

Regional Water Quality Control Board. These allocations were then summed to arrive at a total figure for the amount of residential lots or units developed. Under buildout conditions, it was assumed that all lots would be developed. Under scenarios with only partial buildout, it was assumed that 34 percent of development in STPUD would occur in SEZs. This is consistent with CTRPA's experience over the past 3 years. For DCSID, a simple ratio was set up to estimate future development in SEZs. Within each major traffic zone, the ratio of available housing units in SEZs to total available housing units was determined. If the ratio was 20 percent, then 20 percent of the development allocated to the traffic zone would occupy units in SEZs. Likewise if the ratio were 4 percent, then 4 percent of the development for that traffic zone would be in units in SEZs.

The figures understate the level of construction in SEZs because there is also commercial development in SEZs. Although TRPA prohibits construction of structures other than single-family dwellings in SEZs, variances allowing other types of development can be obtained from the Governing Board.

It should be noted that estimates of urban encroachment on SEZs are based on past development trends. However, as noted in the discussion on mitigation, STPUD, DCSID, and local governments must assure EPA that future development does not result in degradation of tributary streams and near-shore waters. Therefore, the amount of growth which will be allowed to occur in SEZs may not follow past trends.

Description

Under the low growth scenarios for STPUD, SEZs around the state line, Tahoe Keys, and the northern part of Montgomery Estates would be subject to land disturbance. Under Scenario 3, SEZs the northern part of Bijou, Tahoe Paradise would also be subject to urban encroachment. The affected SEZs in the DCSID area are predominantly in the Kingsbury area.

Development in SEZs would result in vegetation removal and land disturbance and, consequently, in erosion. Urban runoff, sedimentation, and nutrient input from erosion would accelerate eutrophication in Lake Tahoe and decrease its value as a fish and wildlife habitat. These impacts have the effect of diminishing the natural beauty of the basin and its attractiveness as a recreational area.

SEZs currently serve an important role in removing pollutants from surface runoff. Development in these sensitive areas could eliminate this natural capability for water treatment. The actual loss of this capability depends on the specific characteristics of the disturbed meadowland.

Critical Implications

Critical damage would occur to SEZs at growth levels projected under all scenarios. In particular, growth levels anticipated under Scenarios 2 and 5 would result in complete development of all lots in SEZs in the STPUD area; under Scenarios 4 and 5, the situation in DCSID would be similar. If development patterns occur as estimated for Scenario 3, half of all SEZs in the south shore area would be converted to urban uses. Functioning meadowlands (i.e., those providing effective treatment) in the south shore area, Blackwood Road Drainage and Trout Creek, could be made ineffective or even eliminated.

Question: How will urbanization of the basin affect pollutant loadings and lake concentrations?

	1976	1	Growth Scenarios			5
			2	3	4	
Suspended solids			The increases in pollutant loading and lake concentrations will lie between the 1976 values and the scenario 5 values. To be any more specific would require making assumptions about the location of future development, the land capability of these areas, the type of land use, and the affect on surface runoff quality and quantity			
Loading	$64 \times 10^6 \text{ kg}$					$75.8 \times 10^6 \text{ kg}$
Lake concentration	2.6 mg/l					6.0 mg/l
Nitrate						
Loading	$18.6 \times 10^6 \text{ gm}$					$20.6 \times 10^6 \text{ gm}$
Lake concentration	13.0 $\mu\text{g/l}$					15.7 $\mu\text{g/l}$
Total Nitrogen						
Loading	$149 \times 10^6 \text{ gm}$					$168.4 \times 10^6 \text{ gm}$
Lake concentration	133 $\mu\text{g/l}$					178 $\mu\text{g/l}$
Total Phosphorus						
Loading	$80.9 \times 10^6 \text{ gm}$					$94.3 \times 10^6 \text{ gm}$
Lake concentration	9.3 $\mu\text{g/l}$					16.9 $\mu\text{g/l}$
Total Iron						
Loading	$197.4 \times 10^6 \text{ gm}$					$204.3 \times 10^6 \text{ gm}$
Lake concentration	20.0 $\mu\text{g/l}$					20.0 $\mu\text{g/l}$
Impact rating		Low	High	Medium	Medium	Extreme

The values for Scenario 5 are based on TRPA's Regional Plan which proposes substantial increases (greater than 40 percent) in acreage of low density residential, high density residential, recreation, and conservation reserve. (Much of this land is presently zoned general forest.) The values for Scenario 5, thus, reflect changes not only in the STPUD and DCSID service areas but also in the rest of the basin. This means that the affect of urbanization in the EIS study area alone cannot be isolated, but as one of the major growth centers in the basin it can be assumed to contribute a large portion of the increases in pollutant.

The pollutant loadings for Scenario 5 are based on assumptions that runoff quality, runoff volumes, and management practices will not change from existing conditions. Thus, the only factor causing changes in loadings between 1976 and the year-2000 under Scenario 5 is change in land use. Lake concentrations were derived by TRPA using the equation in Table 28. The values describe ultimate, steady-state conditions (i.e., conditions when the lake concentrations stabilize 50 to 100 years from now).

The impact ratings are based on the number of housing units developed under each scenario. It is assumed that these figures are indicators of the amount of land disturbance and, thereby, an indicator of pollutant loading. At most, these ratings and the values for 1976 and Scenario 5 should be used only to give a general idea of future changes in lake conditions. The values are based on a number of assumptions which may or may not be acceptable to others. For example, the California SWRCB has calculated sediment yield under present development and under TRPA

Regional Plan. The results of 61,000 and 72,000 tons per year, respectively, are much lower than TRPA's estimates, but the percentage increase in sediment yield is the same.

Description

The greatest percentage change in the lake concentration is in suspended solids (131 percent) and total phosphorus (82 percent). The resultant concentration for total phosphorus of 0.0169 mg/l exceeds the water quality standard of 0.008 mg/l for the lake. The combination of increased phosphorus and nitrate loadings would stimulate algal growth (as described in "Effects of Urbanization" and the next impact question). The increased suspended solids loading would be particularly noticeable in near-shore areas where it would reduce clarity of the water, disturb fish and wildlife habitat, and detract from aesthetic enjoyment of the lake.

Changes in pollutant loadings for specific watersheds in the study area are presented below. Again, the intent of including these values is to note the relative changes and not focus on the values themselves. The greatest percentage change in loadings are seen in the Burke Watershed in DCSID and in the Bijou, Trout and Upper Truckee watersheds in STPUD. The loadings from STPUD and DCSID for sediment and nutrients represent 50 percent or more of the total basin loadings.

NUTRIENT AND SEDIMENT LOADINGS BY WATERSHED LAKE TAHOE BASIN

#	Watershed Name	Suspended Solids (kgx10 ⁺⁶)		NO ₃ -N (gm ³ x10 ⁺³)		Total Nitrogen (gm ³ x10 ⁺⁶) *		Total Phosphate (gm ³ x10 ⁺⁶)		Total Iron (gm ³ x10 ⁺⁶)	
		Existing Land Use	General Plan	Existing Land Use	General Plan	Existing Land Use	General Plan	Existing Land Use	General Plan	Existing Land Use	General Plan
DCSID											
27	Deadman Pt.	0.02	0.02	9	9	0.05	0.06	0.03	0.03	0.11	0.11
28	Slaughter House	0.25	0.25	100	100	0.75	0.75	0.37	0.37	1.19	1.19
29	Glenbrook	0.40	0.34	107	77	0.75	0.57	0.39	0.31	1.30	0.84
30	North Logan House	0.08	0.06	25	23	0.20	0.18	0.11	0.09	0.27	0.27
31	Logan House	0.12	0.12	46	46	0.36	0.36	0.18	0.18	0.51	0.51
32	Cave Rock	0.05	0.05	17	16	0.14	0.13	0.07	0.07	0.17	0.16
33	Lincoln	0.12	0.12	42	42	0.34	0.33	0.18	0.18	0.44	0.43
34	Skyland	0.10	0.17	22	36	0.21	0.33	0.12	0.20	0.11	0.12
35	North Zephyr	0.10	0.11	41	46	0.33	0.40	0.16	0.19	0.57	0.70
36	Zephyr	0.31	0.10	53	35	0.37	0.32	0.20	0.17	0.71	0.49
37	South Zephyr ¹	--	--	--	--	--	--	--	--	--	--
38	McFaul	0.30	0.33	84	97	0.70	0.81	0.39	0.52	0.71	0.93
39	Burke	1.06	1.29	188	219	1.44	2.15	0.94	1.53	2.15	2.94
40	Edgewood	1.82	2.41	322	387	2.34	2.76	1.38	1.72	3.18	3.80
STPUD											
41	Bijou Park	3.28	3.23	405	422	2.70	2.82	1.79	1.94	3.66	4.04
42	Bijou	0.88	1.42	168	231	1.58	1.93	1.00	1.30	1.32	2.06
43	Trout	4.34	5.28	1,484	1,617	11.86	13.07	6.17	7.07	16.52	17.22
44	Upper Truckee River	15.34	16.73	4,304	4,483	35.59	37.75	19.78	21.34	46.82	47.57
45	Camp Richardson	0.54	0.49	142	138	1.25	1.23	0.66	0.65	1.89	1.85
46	Taylor Creek	3.40	3.50	1,292	1,306	9.94	10.05	5.12	5.07	14.65	14.66
47	Tallac	0.60	0.61	225	239	1.76	1.99	0.90	1.07	2.66	2.74
48	Cascade	0.83	0.83	350	349	2.62	2.60	1.29	1.26	4.30	4.31
49	Eagle Creek	1.54	1.54	655	655	4.87	4.87	2.36	2.36	8.10	8.10
Total		35.48	39.0	10,081	10,603	80.16	85.46	43.59	47.62	111.34	115.04
Percentage Increase		9.9		5.2		6.6		9.2		3.3	

¹ Values are included with Watershed #36.

Source: Tahoe Regional Planning Agency, Lake Tahoe Basin Water Quality Management Plan, Vol. III, 1977.

Critical Implications

See discussion above.

Question: How will accelerated eutrophication affect Lake Tahoe?

Measurements

	1976	1	2	<u>Growth Scenarios</u>		5
				3	4	
Clarity of the lake during critical spring months (percent reduction from existing conditions)	26.4 meters	-	5-10	5-10	5-10	10-20
Algal growth rate (percent increase from existing mean annual conditions)	0.180 mgC/m ³ /hr	-	7.5-15	7.5-15	7.5-15	15-35
Impact ratings		Low	Medium	Medium	Medium	High

Measurements for algal growth and water quality clarity under the scenarios are based upon levels of water quality constituents projected by TRPA for conditions under the General Plan in the year-2000. Changes in algal growth are measured as changes in average primary productivity; changes in clarity are measured as changes in Secchi depth. The projected changes for algal growth are the result of stimulation of Lake Tahoe water in a flask by the addition of nitrogen and phosphorus and of nitrate and iron. The environmental conditions peculiar to a flask cannot reflect the ambient quality of a large body of water, and therefore the correspondence between these values and those actually in the lake are unknown. The percent change between existing and future spring conditions for primary productivity is a 5-20 percent increase and for clarity a 5-10 percent decrease. Changes under Scenario 1 are assumed to be minor and unlikely to cause a measurable change in clarity or algal growth rate.

Description

Existing level of development have already resulted in water quality problems in the Lake Tahoe Basin. Increased development would accelerate the degradation of water quality in Lake Tahoe and its tributaries by increasing erosion and sedimentation and, hence, stimulating algal growth as described earlier under "Effects of Urbanization." The most severe problems would occur in near-shore waters adjacent to dense urban development.

Violations of state and federal water quality objectives standards for plankton county and algal growth potential have been recorded.

Critical Implications

Under Scenario 1, the visual aspects of the lake would degrade faster than the chemical and biological quality of the lake. However, under Scenarios 2 through 5, water quality parameters related to biological aspects would show measurable changes. Based upon current surface wastewater management practices, under Scenario 5 (full buildout), loadings of suspended solids would increase 140 percent over those under natural, undeveloped conditions, and levels of nutrients reaching Lake Tahoe would increase 65 percent. (TRPA, 1977a). These percentages may vastly understate the change, because SWRCB data indicate that natural levels are much lower than thought by TRPA. As mentioned under the previous impact question, the key beneficial uses that would be adversely affected by reduced clarity and greater algal growth include non-water-contact recreation, cold and warm freshwater habitat and wildlife habitat.

4. MITIGATION MEASURES

Protection of water from point and nonpoint discharges and making it "fishable and swimmable" are the goals of the "200" water quality management program, as described by the Federal Water Pollution Control Act Amendments of 1972. The output of the program is a plan that prescribes a series of measures to address the region's more critical water quality concerns. Nevada has conditionally approved TRPA's plan, but California is in the process of preparing its own. The mitigation measures chosen from this EIS to protect water quality from adverse impacts from the STPUD and DCSID programs should be consistent with those measures adopted in the water quality management plan for the basin.

1. Implement an SEZ ordinance or a similarly restrictive land use control measure to restrict development in SEZs.

Description. Unsubdivided lands within SEZs would be rezoned to prohibit urbanization. Development in undeveloped but subdivided lands would either be prohibited or be subject to restrictive conditions aimed at retaining the natural capability for runoff conveyance and treatment. Approval of a building permit would be contingent upon agreement of property owners to meet certain conditions, which might include relocating the project, building on piers, providing infiltration trenches, or constructing drainage facilities.

The 208 plan adopted by TRPA on January 25, 1978, requires that development on SEZ and high erosion hazard lands comply with "the appropriate methods contained in the Handbook of Best Management Practices." Further, within one year of the effective date of the ordinance implementing the plan, "a specific plan for the management of SEZ (sic) containing the elements required by the Plan (sic) shall be prepared for consideration of interested parties" (TRPA, 1978, pp. 1-69-70). The plan's implementation program calls for local agencies, TRPA, and U.S. Forest Service (for federal lands only) to institute, within one year of plan adoption, zoning and ordinance revisions to protect SEZs and high hazard lands (TRPA, 1978). The continuing planning program further requires TRPA and U.S. Forest Service to complete SEZ plans and refine zoning maps within one year of plan adoption (TRPA, 1978).

The summary of the adopted 208 plan (but not the draft ordinance) specifies:

For areas that were identified as stream environment zones in a natural state, future development, to the extent feasible, will be limited to lands outside the stream environment zone boundary.

For areas that have been identified as water influence areas (i.e., SEZs in a partially developed state and now zoned for urban use) which are subdivided and building out, every effort should be taken to locate future development outside of that portion of the piece of property lying within the identified water influence area. However, if it is impossible to develop the property without encroaching within the identified boundaries, appropriate methods from the BMP (Best Management Practices) will be applied. (TRPA, 1978b, p. 1-18.)

Effectiveness. Could be high if rigorously enforced. TRPA currently requires an administrative permit to develop single-family dwelling units in SEZs. The permit is contingent upon staff findings that project will not encroach upon the SEZ or that measures can be implemented to maintain runoff conveyance and treatment capability. Other development is prohibited; however, a variance procedure enables the applicant to appeal to the Governing Board. Various proposals establishing a growth management program have been developed in which availability of public services and environmental compatibility would determine whether a developer can build. Because development in SEZs is considered environmentally incompatible, this approach may effectively limit construction in SEZs (see mitigation measure 3).

Conflicts would occur between these controls and the desire of owners of existing subdivided lots to realize a return on their investment. Within STPUD, these are 4,129 lots in SEZs, of which 3,627 are residential, that have received the necessary subdivision approvals for development. Each of these lots is assessed annually for sewer facilities that have been extended into its area—even if the lot does not receive sewer service. In Douglas County, there are 298 lots in SEZs, of which 130 are residential, that pay sewer assessments to DCSID or to sewer and improvement districts within the DCSID collection area.

Responsibility. Local governments, TRPA, CTRPA, U.S. Forest Service.

Cost. Administrative, except in instances where landowners would have to be compensated for loss of development rights. The costs of compensation can be mitigated through a system of development-rights transfer, as described under mitigation measure 7.

Timing. As soon as possible to prevent further loss of valuable water resources, wildlife habitat and visual resources.

2. Implement best management practices (BMP) for erosion and sediment control, especially in high erosion hazard lands.

Description. Conditions for any future development activities on high erosion hazard lands would require implementation of BMP to provide proper stabilization and runoff management. The applicability of different BMP could be based on

TRPA's "Handbook of Best Management Practices," adopted as part of the water quality management plan. BMPs include, but are not limited to, revegetation, mechanical slope stabilization, curbs and gutters, paving, channel lining, drainage systems and energy dissipators. Enforcement would be performed through local building and grading permits and would continue with inspection during the construction phases of development. In California, implementation of BMPs should comply with the SWRCB's 208 Manual (currently being prepared). Lahontan RWQCB and Nevada DEP could be called upon to intervene in cases of serious violation.

Effectiveness. BMPs are aimed at controlling erosion at the source and could effectively prevent sediment loss if the appropriate measure is employed. Both TRPA's handbook and the California SWRCB's Demonstration of Erosion and Sediment Control Technology contain valuable information on the cost-effectiveness of different measures.

The process of project review during the application phase provides the most efficient way of ensuring adequate management. It would complement the authority of the Lahontan RWQCB to require specific BMPs through its waste discharge requirements for certain discharges of solid waste. Nevada has similar authority to implement a siltation control program, however, it has not been invoked to achieve such an objective. Where local enforcement is ineffective, Lahontan RWQCB and Nevada DEP could be requested to take direct enforcement action.

Responsibility. In California, local governments, TRPA, CTRPA, Lahontan RWQCB, and SWRCB; in Nevada, local governments, TRPA, DEP, U.S. Forest Service.

Cost. Administrative; would be partially borne by land developers through increased development fees.

Timing. As soon as possible.

3. Adopt evaluative point systems to minimize development in low capability lands such as high erosion hazard lands and SEZs.

Description. Applications for building permits would be evaluated according to a set of development criteria. These criteria may include availability of necessary services, community design standards, community amenities, environmental considerations, aesthetics, conservation considerations, and whatever else the community decides are important. Within each of these broad criteria, a number of specific checkpoints could be used to evaluate a project's compatibility with the criteria. Some of the items proposed by CTRPA as possible checkpoints include: land capability of site, proximity of SEZs or high erosion hazard lands, impact on traffic volumes and air quality, amount of land disturbance, incorporation of BMPs, compatibility with natural landscape, and location with respect to noise generators. A point value is assigned to each of these checkpoints. All applications for building permits are evaluated according to these checkpoints and assigned a ranking based on the number of points earned. Those applications with the highest point total would be processed first.

A ceiling on the number of permits issued may be imposed to stage growth or to prevent overtaxing the remaining capacity of various public facilities. For example, the rate of growth could be controlled by allowing only 300 equivalent single family dwelling units to be connected per year. The location of growth would be managed through the point system, as described immediately above.

Effectiveness. A evaluative point system could be very effective at discouraging development in SEZs, high erosion hazard lands, and any other fragile land. The system is flexible and can be easily modified to reflect community desires. For example, a minimum number of points could be required of all proposed development for the criteria of availability of necessary services and environmental considerations. The maximum number of permits issues could be based on the remaining sewage capacity. If proposed projects are located partially in SEZs or high erosion hazard lands, they could be penalized and a negative point value could be assigned. The system could be applied to new structures, or it could also apply to existing structures that require additional capacity.

Responsibility. Local governments, TRPA, CTRPA.

Cost. Administrative, although it may be partially defrayed by increased building permit fees. It is expected that additional personnel would be required to administer the system and evaluate the permits.

Timing. The city of South Lake Tahoe, CTRPA and STPUD have developed evaluative point systems. The adoption of such a system should be considered as soon as possible to steer anticipated growth away from environmentally sensitive areas.

4. Implement water quality monitoring program to document changes in physical, chemical and biological characteristics of basin waters.

Description. The program would be aimed at providing a consistent base of surface water quality data. Although a monitoring program by itself would not mitigate any water quality problems, it would be useful as a measure of effectiveness for the other mitigation measures, as well as providing a solid technical data base. The following parameters should be considered essential for a continuous environmental monitoring program of the lake: precipitation, evaporation, temperature, sunlight, periphyton and phytoplankton biomass and productivity, zooplankton, lake temperature, light penetration, dissolved oxygen, pH, nitrate and total inorganic carbon (Brown, nd.). Other parameters would be monitored during more intensive studies that could be conducted every five years. An agreed on set of monitoring techniques, sampling points, and schedule for monitoring would be prepared.

Effectiveness. Would be extremely useful toward providing a consistent, long-term investigation of lake quality. Much of the problem in the past has stemmed from using different techniques, sampling points, and time frames to measure the same constituent. Also, because there is currently no well-accepted monitoring program, changes in lake quality and even possible violations of water quality standards are going undocumented.

Responsibility. Lahontan RWQCB, California SWRCB, California Department of Water Resources, Nevada DEP, Nevada Environmental Commission, U.S. EPA, U.S. Geological Survey, U.S. Forest Service, U.C. Davis.

Cost. Would depend on the number of sampling points, the parameters sampled, the frequency of sampling, and the techniques used to sample.

Timing. A proposed program has been prepared by the agencies described above. Implementation of the program could be initiated once the specifics have been agreed upon and the funding made available.

5. Establish a program for purchasing subdivided lots or acres which are zoned for development with urban areas and are in high hazard lands and stream environment zones. (See mitigation measure under "Visual Resources.")
6. Compensate landowners who experience losses because of development restrictions.

Description. Compensation of losses would be necessary as required by law. Problems could arise in finding sources for needed revenues and in agreeing on estimates of losses for which compensation is due. Possible revenue sources would be federal purchase, tax on windfalls gained by those who can build, and possible combinations of federal, state, and local funds.

Effectiveness. Measure would be effective at protecting environmentally sensitive areas and compensating landowners. However, it may not be feasible because of the uncertainty of who could or should pay as required by law.

Responsibility. Would probably be determined by the courts.

Cost. Would depend on which lots and land are not developed, how estimates of losses are made (land residual or existing investments), and whether full or partial compensation is made.

7. Redistribute development to reduce loss among landowners and protect environmentally sensitive areas through transfer of development rights.

Description. Transfer of density or development rights (TDR) is a technique for regulating land use. The concept behind it is that development rights can be severed from the "bundle of rights" associates with ownership of a particular parcel of land and transferred to another parcel, either through sale, gift, or exchange.

Most TDR systems call for the creation of transfer and receiving zones. The transfer zone is the area identified by the TDR system as appropriate for no- or low-density development. The receiving zone is designated to receive the increment of development that would otherwise occur in the transfer zone. In the Lake Tahoe Basin, low capability and SEZ lands would be in the no- or low-development (transfer) zone; high capability lands or lands outside the basin would be in the receiving zone.

The purpose of the TDR system is to restrict transfer lands to the desired level of development and provide the owners of these lands with some compensation for this

restriction. In order to accomplish this objective without expenditure of public funds, the TDR system a) identifies the development potential of the transfer zone; b) severs this potential from the land; c) quantifies it into development or density units; and d) creates a market for the purchase and transfer of these units to the receiving zone by permitting higher density development than would otherwise be possible if a developer had acquired a specified quantity of development units. Once the owner of a parcel of transfer zone land has sold or otherwise disposed of his development units, the future development potential of this parcel is extinguished by the deed restriction. In effect, a TDR system operates so that the costs of public land use restrictions are borne by the private sector, which is, in turn, permitted to develop selected lands at higher densities.

Effectiveness. For successful operation, a) the system must be founded on a planning rationale, and the designation of the transfer and receiving zones must closely reflect these planning goals and objectives; b) some entity must be responsible for establishing the system, monitoring its performance, and intervening in the development units market when necessary to correct defects in its operation; and c) the system must be capable of achieving a market equilibrium between supply of development units and demand for them.

To date the TDR concept is largely untried in the western United States. The California Coastal Commission recently used TDR in a very limited capacity to shift development from undeveloped, small-lot subdivisions in the Malibu-Santa Monica Mountains to "infill" areas in the coastal lowlands. Here the planning goal was to avoid the adverse water quality, visual, geologic, and fire hazard impacts that would result from the buildout of these mountain subdivisions.

Responsibility. Local government, TRPA, CTRPA, EPA.

Cost. Although one of the primary purposes of a TDR system is to regulate the use of privately owned lands without incurring public costs, any such system will necessarily require a significant public investment. In almost all cases, the TDR system would be established and administered by a government entity. Given the sophistication of this concept and the complexity of a development units market, start-up and operations costs are likely to be high.

A TDR system would also affect private sector costs to the degree that overall land development is restricted. The exact nature and incidence of these costs would depend on the goals of the TDR system established.

Timing. A preliminary study of the TDR has been done by CTRPA for the California side of the basin. A basinwide study is needed and should be coordinated with on-going studies and programs.

D. OTHER INDIRECT EFFECTS (SECONDARY IMPACTS): NATURAL RESOURCES AND ENVIRONMENTAL QUALITY IN LAKE TAHOE HYDROGRAPHIC BASIN

I. GEOLOGY AND SOILS

EXISTING CONDITIONS

During the late Tertiary period of the Cenozoic era, volcanic activity deposited new rock material over the existing plains. Some 25 to 40 million years ago, this rock mass tilted upwards and formed the Sierra Nevada. A vast fault "block" then dropped below the surrounding land to form a valley, which volcanic eruptions later sealed. These geologic events, along with precipitation and runoff, formed a "pre-Lake Tahoe." Erosion and the four great periods of glaciation created the present shape of the lake.

Geologic drift, hot springs, faults, and earthquakes are characteristic of the active Lake Tahoe region. Major faults run north-south through the basin and under Lake Tahoe. Smaller fault networks exist on all sides of the basin. The north-south fault, which runs along the western lakeshore, can theoretically cause an earthquake of magnitude 7.5 and a 10-foot surface displacement. All faults within the basin are considered potentially active, and an earthquake of magnitude 7 (or greater) could occur once every 110 years within a 25-mile radius of Lake Tahoe. Catastrophic inundation, extensive landslides, and snow avalanches are attendant dangers. Figure 9 shows faults in the Lake Tahoe area.

Most soils in the Lake Tahoe Basin were formed from granitic and volcanic rocks. Soils formed from granitic rocks cover the southern and eastern sides of the basin. Ranging from deep to shallow depths over grus (decomposed granitic rock), these soils have a coarse texture, low water-holding capacity, and low plant-nutrient content. Revegetation of disturbed lands in this area is difficult at best. As a result, erosion hazards and sediment yields are high. The northern sections of the Lake Tahoe area are primarily composed of soils formed from volcanic rocks during the tertiary and quaternary periods. Ranging from moderately deep to deep over fractured bedrock, these soils have a coarse texture, water-holding capacity, and moderate natural fertility. The erosion hazard in this area varies from slight to high. Disturbed land is associated with increased water yield and decreased slope stability, which in turn increase flood and landslide hazards.

A smaller percentage of soils in the Lake Tahoe Basin were formed from glacial outwash, glacial moraines, lake terraces, and recent alluvium. Stony, sandy soils containing small boulders were formed from glacial deposits and lie on gentle to steep moraines and on outwash on the southern and western sides of the basin. Characterized by low fertility and low water-holding capacity, these soils overlie poorly developed land and compacted till, which restricts the downward movement of water. The erosion hazard in this area ranges from slight to high. Surface excavation, freezing, and thawing are often followed by downward rock movement.

Figure 9 GEOTECHNICAL HAZARDS LAKE TAHOE BASIN

REGIONAL FAULTS

- KNOWN LOCATION
 - - - - - APPROXIMATE LOCATION
 CONCEALED

Disturbed lands in this area deliver large sediment loads to streams. Soils formed from alluvium have been deposited around the margins of the lake and along stream channels. These soil types exist in terraces, coarsely textured glacial outwash, fans, and floodplains. With coarse to moderately coarse textures, these soils are very deep on nearly level to steeply sloping terrain. The erosion hazards in such areas range from slight to moderate. Disturbed soil causes streambank erosion and silt and clay deposition in Lake Tahoe.

About one-half of the basin land has slopes steeper than 20 percent. Most of the basin's gently sloping lands, which reach elevations of 6,600 feet at the boundary along Cold Creek, are at the southern end of the basin. This area supports a greater number of inhabitants than the northern end, although development of the low-gradient alluvial fan in the Incline Village area is increasing.

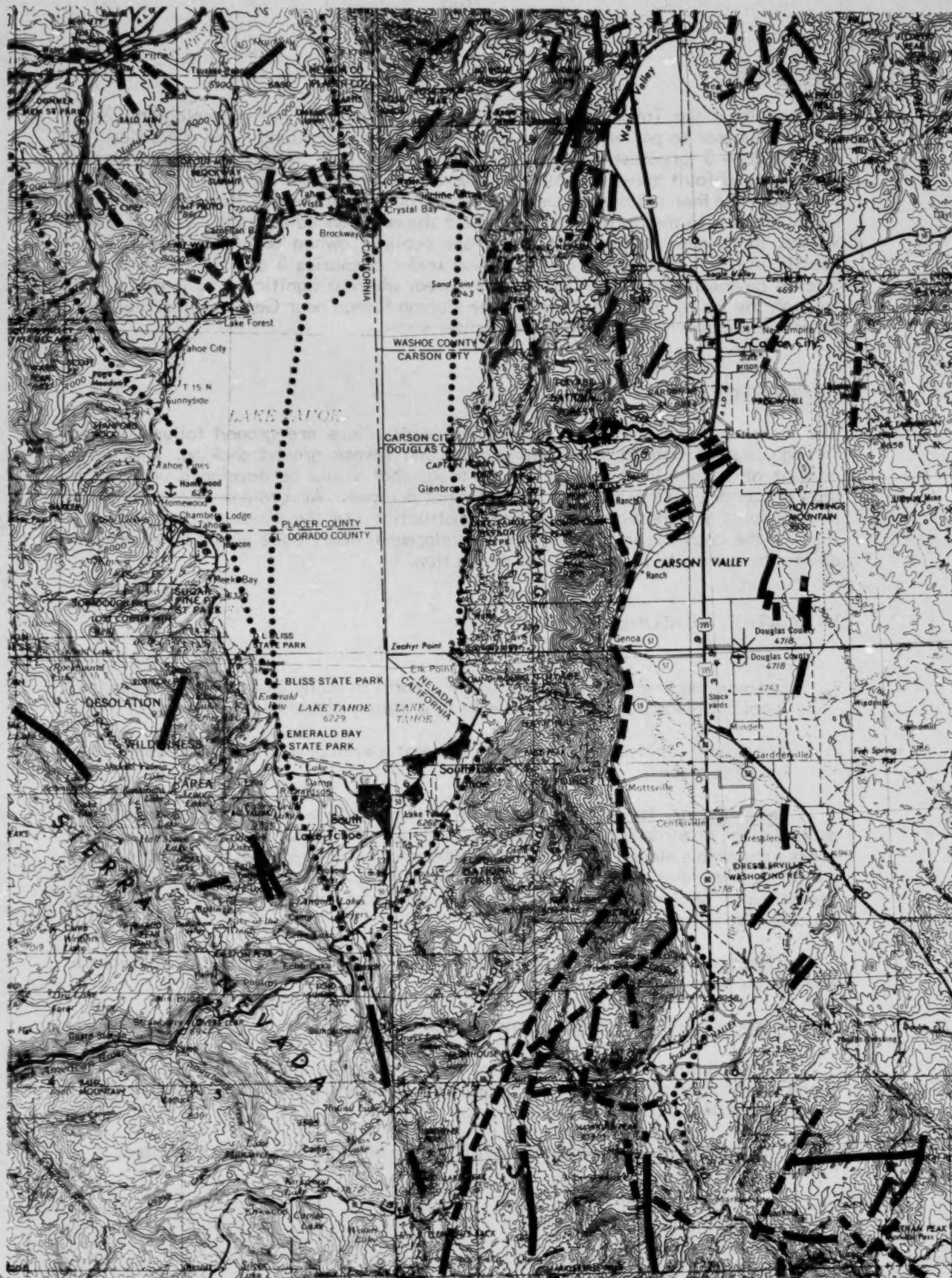
IMPACT ASSESSMENT

Question: What will be the potential for damage from seismic activity?

Measurements

	Growth Scenarios				
	1	2	3	4	5
Damage levels of major earthquake	Low	Medium	Medium	High	High

Ratings compare qualitatively the potential level of damage to property. It is assumed that higher damage levels will occur under scenarios with higher levels of development.



Description

Because the Lake Tahoe Basin and the Carson Valley are active geological zones and are subject to periodic earthquakes, the Uniform Building Code classifies the area as zone 3 (greatest potential for seismic activity). In the Lake Tahoe Basin, areas around fault zones are already intensively developed. Scenarios 2, 3, and 5 anticipate further residential development around Montgomery Estates and in the neighborhoods to the north, where Figure 9 shows a concealed fault. In the Carson Valley, lands near major fault zones are publicly owned or are zoned for low-density use, but high spillover population under Scenarios 4 and 5 may stimulate intense development in the Jacks Valley area, where a significant fault runs north through the valley along the base of the Carson Range near Genoa. This fault has an estimated potential of 7.0 on the Richter scale.

Critical Implications

The most serious natural hazards in the south shore are ground failure, either through liquefaction or lateral spreading, and severe ground shaking. The large amount of vacant land in high hazard areas that would be developed under high growth scenarios is an indicator of potential damage. Accordingly, limitations on development and increased costs for construction are the major critical implications of the area's seismic potential. Development near faults would be expensive due to the necessity for earthquake protection.

MITIGATION MEASURES

1. Enforce pertinent building codes. (Uniform Building Code requirements and local building codes, already in effect, dictate precautionary measures.)
2. Implement land use controls to prevent development on fault zones and unstable slopes.

Description. The most feasible mitigation measure to prevent damage from geotechnical hazards is a well-planned land use program. Areas close to fault zones or unstable slopes should be identified, and this information incorporated into comprehensive land use plans and zoning ordinances. In potentially active areas, geotechnical analyses to determine slope stability should be performed before construction is begun.

Effectiveness. Could be effective in reducing property and infrastructure damage from major earthquake.

Responsibility. Local governments, CTRPA, and TRPA.

Cost. Administrative. Geotechnical analyses may cost \$1,500 to \$5,000 and would increase housing costs accordingly. Preventive measures may cost up to 20 percent of total housing costs.

Timing. Should be coordinated with update of regional and general plans.

2. BIOLOGY

EXISTING CONDITIONS

Vegetation

Vegetational communities of the Lake Tahoe Basin include communities of open waters and marshes of Lake Tahoe and other lakes and streams; meadows and bogs; streambanks; conifer forests; montane chaparral; and, at the higher elevations, alpine and subalpine regions. Aquatic vegetation in the lake grows to depths of 400 feet (120 to 150 meters) in Lake Tahoe (TRPA and U.S. Forest Service, 1971b; Moyle, 1976). Algae such as *Cladophora* occupy the deepest zones, and in the shallower regions, mosses, liverworts, and aquatic flowering species are found. The off-shore shelf at the southern end of Lake Tahoe supports extensive beds of submerged plants. In contrast to the investigation Lake Tahoe has received, the vegetation in other lakes and streams of the basin is not well known (TRPA and U.S. Forest Service, 1971b).

Meadows are found where the soil is too shallow or too continuously moist to support woody vegetation (Orndoff, 1974). The wet variety form where decomposed granitic soils have filled depressions in the bedrock substrate. They gradually dry out, change in composition, and eventually become colonized by forest trees (Storer and Usinger, 1963). Wet meadows constitute one of the most valuable biological resources in the Lake Tahoe watershed. Not only do they provide excellent wildlife habitat, but recent work has shown that they can improve the quality of water flowing across them (Morris, et al. n.d.). *Sphagnum* bogs are typified by vascular plants such as mountain laurel, bog orchid, and sedges, as well as the dominant mosses. They are found in scattered locations throughout the Lake Tahoe basin, especially around the perimeters of high-altitude lakes.

Riparian communities along streambanks include thickets of willows, heathers, and sedges at the highest elevations; mountain alder, bitter cherry, serviceberry, American dogwood, mountain ash, and quaking aspen at lower altitudes; and black cottonwood and willows in the lowest reaches of the Lake Tahoe basin. Alder, a genus found in many North American wetlands, frequently grows in pure, dense stands in seepage areas throughout the study area. A number of herbaceous species, including ragwort, western columbine, and paintbrush can also be found in streamside zones. These zones are critical to maintain as wildlife and fish habitats.

Coniferous forests in the Lake Tahoe Basin include several community types. The associations at lowest altitudes roughly correspond to the "Pure Pine" association and much of the "Mixed Conifer" community defined by TRPA and U.S. Forest Service (1971i). They are dominated by Jeffrey pine, sugar pine, and white fir. Typical understory species include huckleberry oak, greenleaf manzanita, and tobacco brush. The forests on the east side of the basin receive less precipitation and retain annual snowpack for a shorter period than those to the west. Consequently, their understory is composed of the bitterbrush-sagebrush-rabbitbrush complex typical of the adjacent, semi-arid Carson Valley. Lodgepole pine is an important tree in the margins of wet meadows and bogs and in regions with shallow soils. Red fir becomes more abundant and white fir populations decrease at successively higher elevations. Similarly, western white pine gradually replaces

lower elevation pine species. Desert mountain mahogany prevails on the eastern rim because of drier weather conditions.

Above approximately 8,000 feet, soils are shallow, the growing season is short, and the vegetation is variable. The highest elevations (above 9,800 feet) are characterized by communities of scattered, herbaceous plants. These alpine communities support fleabanes, Sierra chaenactis, penstemon, and many other species.

Chaparral communities in the study area occur where fires or timber cutting have eliminated the forest overstory (Neilson, 1973). Dominant species are typically similar to the understory in nearby forest regions. Greenleaf manzanita and tobacco brush are the most abundant components of this vegetative association.

Each of these plant communities or habitat types has undergone some change as a result of human activity in the Lake Tahoe Basin. Houses, roads, and paved surfaces have replaced many communities entirely, and air pollution, soil compaction caused by foot traffic and off-road vehicles, and mechanical injury have caused damage to the remaining plants in urbanized regions. In residential areas, much overstory vegetation has been retained because of its aesthetic value, but most understory vegetation has been removed. Lawn and other ornamental plantings replace this loss in some measure, but have not coevolved with the other vegetation and wildlife and often require extra water. Fertilizer and chemicals for protection from insects may cause damage to other components of the ecosystem. Roots cut or bark scarred during construction makes trees susceptible to rot and insect attack and subject to further infestation. Felled trees or even stacked green firewood can become breeding centers for bark beetles, which can then attack and kill other trees (Hunt, 1971).

Rare, Threatened, or Endangered Species. Although no plants proposed by the U.S. Fish and Wildlife Service for inclusion on the official listing (41 FR 117, June 16, 1976) grow in the Lake Tahoe Basin, six species of interest to the California and Nevada Native Plant Society are found there. The locations of these species are shown in Figure 10.

Tahoe yellow cress (*Rorippa subumbellata*), which grows in scattered locations around the shoreline in both states is considered by the native plant societies to be rare and endangered (Powell, 1974; Penzl, pers. comm.). Sierra sedge (*Carex paucifructa*), one of the rarest plants in California (Smith, 1973) and considered rare and endangered, has been collected in the Desolation Wilderness (Powell, 1974; Smith, 1973). A rare but not endangered composite, *Hopplopappus eximius*, also grows on peaks in the Desolation Wilderness (Powell, 1974; Smith, 1973). On peaks of the Carson Range on the eastern side of the basin are populations of two small members of the mustard family: *Draba stenolopa* var. *ramosa* and *D. asteriphora*. The Nevada Native Plant Society lists these *Drabas* as threatened species (Penzl, pers. comm.). *Lupinus montagenus* is considered by the California Native Plant Society to be rare but not endangered.

Unique and Sensitive Areas. These areas, which include natural areas designated by the California Natural Areas Coordinating Council (Hood, 1978), the Freel Peak-Job's Sister area plant association, and stream environments zone are ecologically sensitive areas and are considered biologically significant. The six designated natural areas include the Desolation Wilderness, owned and managed by the U.S. Forest Service; three lakeshore state parks (D.L. Bliss, Emerald Bay, and Sugar Pine Point); and two sphagnum bogs (Grass Lake and Osgood Swamp). Osgood



Figure 10 AREAS OF BIOLOGICAL SIGNIFICANCE LAKE TAHOE BASIN

AREAS OF PRIMARY SIGNIFICANCE

RARE OR ENDANGERED SPECIES SOURCE: CALIFORNIA NATIVE PLANT SOCIETY

RECENT OBSERVATION - LOCATION NOT PRECISELY KNOWN

RECENT OBSERVATION - PRECISE LOCATION KNOWN

COLLECTION BEFORE 1945 - LOCATION NOT PRECISELY KNOWN

C · CAREX PACIFRUCTA

D · DRABA STENOLOBA VAR RAMOSA

DR · DRABA STENOLOBA VAR RAMOSA

DA · DRABA ASTERIPHORA

FREEL PEAK - JOB'S SISTER ALPINE PLANT COMMUNITY

OSPREY NESTING AREA (1976 - 78)

CALIFORNIA NATURAL AREA

DEER MIGRATION CORRIDORS

R · RORIPPA SUBUMBELLATA

H · HAPLOPAPPUS EXIMIUS

NEVADA ST. MUSEUM

LM LUPINUS MONTAGENUS

RO RORIPPA SUBUMBELLATA



Tahoe Region Environmental Evaluation Study

**U.S. Environmental Protection Agency
Sedway/Cooke**

B



Swamp has been partially drained, but the unique quaking bog at Grass Lake is largely undisturbed (Hood 1978). These sites are shown in Figure 10.

The small, sensitive community of alpine plants of the Freel Peak-Job's Sister area occurs at altitudes over 10,000 feet on the ridgetops and is one of the northernmost occurrences of this plant association (TRPA and U.S. Forest Service, 1971i).

Stream environment zones (SEZs) encompass rivers, creeks, lakes, ponds, meadowlands, marshes, and other areas associated with water. They are valuable for the maintenance of water quality and as wildlife and fish habitat (see "Water Resources and Water Quality").

Wildlife

Wildlife habitats are usually defined on the basis of vegetation, which provides food, cover, and nesting, denning, and perching sites. Use of these available habitats is influenced by the condition of the vegetation and by the degree of human disturbance there. Slightly over half of the Lake Tahoe Basin lies within the boundaries of a state park or national forest, where wildlife populations and habitats are protected. However, the high level of human activity in the basin has sharply reduced the value of the wildlife habitat, especially along the lakeshore (TRPA and U.S. Forest Service, 1971j). Even relatively remote regions without actual development have been affected by hikers, campers, pack trains, and anglers (Reed, pers. comm.).

Rare, Threatened, or Endangered Species. The southern bald eagle (*Haliaeetus leucocephalus*) is listed by the U.S. Fish and Wildlife Service (40 FR 44417, September 26, 1975) as an endangered species. Bald eagles, regular winter visitors to the Lake Tahoe Basin, are most often sighted in the Truckee Marsh and Taylor Creek area. Kokanee salmon, a primary dietary item for the Lake Tahoe Basin eagles, commonly spawn in those areas in October and November (Reed, pers. comm.). Although suitable habitat is still available, bald eagles, discouraged by increased human activity, no longer nest around Lake Tahoe (Reed, pers. comm.).

The peregrine falcon (*Falcon peregrinus*), another endangered species, has historically nested on Cave Rock and near Echo Summit. Because populations of waterfowl and shorebirds, the peregrine prey base, have been much reduced in the basin. Peregrines are now sighted in the area only during migration (Reed, pers. comm.).

The only actively breeding pair of osprey in Nevada (*Pandion haliaetus*) nest in private and public land along the east shore of the lake. They feed almost exclusively on fish. Ideal nest sites for the osprey are those on prominent dead snags surrounded by or near water.

Although not included in the federal list, the wolverine (*Gulo luscus*) is considered rare by the California Department of Fish and Game (1976). Sightings of these secretive animals are infrequent, and consequently it is difficult to make population estimates. Suitable wolverine habitat exists in the more remote, forested regions of the watershed, and wolverines are thought to be resident there (Reed, pers. comm.).

Fish

Fishing in Lake Tahoe is a popular sport even though other lakes and streams in the area may be more productive (TRPA and U.S. Forest Service, 1971b). Management of fishery by the California and Nevada departments of fish and game is aimed at satisfying angler demand and maintaining a healthy, self-sustaining aquatic ecosystem in the lake.

Important fish habitats are nearshore rocky bottoms and shallow-water macrophyte beds; streams with riffles, pools, and suitable spawning gravels; and the deep-water algae beds associated with deep-water benthic fauna (Moyle, 1976; PBRMG, 1978). Sandy or silty bottoms are less valuable as habitat (PBRMG, 1978). All streams and tributary lakes in the Lake Tahoe Basin are at present still valuable sources of fish food and are still productive (Wickwire, pers. comm.). Both native and introduced species use the streams for spawning, and many trout spend the year there (Wickwire, pers. comm.).

The introduction of nonnative fish has changed somewhat the faunal species composition and the synecological relationships of Lake Tahoe. However, the primary reason for the recent decline in fish populations (TRPA and U.S. Forest Service, 1971b; Wickwire, pers. comm.) can be attributed to the degradation of important fish habitats, particularly along streams, by urban development and other human activities (TRPA and U.S. Forest Service, 1971b; Davis, pers. comm.; Wickwire, pers. comm.). These activities have resulted in both siltation and direct destruction of habitat. Siltation is the transport of suspended sediments to the lake, where heterotrophic bacteria attack the sediment and release nutrients, which can then be taken up by algae. In moderate amounts, this food supply enrichment can benefit fish in a nutrient-limited, oligotrophic environment like Lake Tahoe, but algal blooms and turbidity deplete dissolved oxygen, reduce light penetration, and adversely affect aquatic plant life, an essential component of the fish food web.

Direct destruction of spawning habitat is another serious impact of urban development on fish population. The Upper Truckee River once supported a healthy fish population, but deposits of sand and channelization near the airport have eliminated stretches of rocky riffles and pools (Wickwire, pers. comm.). Large-scale habitat conversion and development of the Truckee Marsh may be correlated with reduced spawning activity in area streams and an overall reduction of fish populations in the south Lake Tahoe region (Wickwire, pers. comm.). Fish kills in Edgewood Creek (Douglas County), which catches urban runoff from the intensively developed south shore casino district have been attributed to severe reductions in water quality (Davis, pers. comm.).

Another consequence of more people in the basin is the increased amount of poaching during spawning season. Catching fish by netting or other illegal means lowers fish populations of streams by eliminating spawning adults before they lay eggs.

Sensitivity Ranking

The areas of primary biological significance in the basin include wet meadows, riparian zones, marshes, bogs, deer migration corridors, and sites that support rare, endangered, or otherwise important plant or animal species. Other undeveloped regions that support native wildlife and vegetation are more widespread, frequently less productive, and less vital to protected or economically important species. These regions are second in importance to the critical regions mentioned above. Urbanized

areas that do not impinge upon riparian zones are third in importance to native plant and animal life. The locations of these regions and their relative biological values are shown in Figure 10.

IMPACT ASSESSMENT

Question: To what extent will rare and endangered species and other resources of biological significance be adversely affected?

Measurements

	1	2	<u>Growth Scenarios</u>		5
			3	4	
Wet meadows wildlife habitat in upper elevations	Low	Medium	Low	Medium	Medium
Bald eagle populations	Low	Medium	Low	Low	Medium
Osprey nesting areas	Low	Medium	Low	Low	Medium
Rare or endangered plants	Low	Medium	Low	Low	Medium
Natural areas	Low	Medium	Low	Low	Medium
Eastern rim of basin	Low	Low	Low	Low	Medium
Stream environment zones	Medium	High	High	High	Extreme

Ratings assume that state parks and national forest lands will remain undeveloped; the extent and impact of recreational use will increase proportionally with residential and economic growth; and recreational use on the western rim of the basin will be greater than on the eastern rim.

Description

Moist habitats in the upper elevations--meadows, bogs, small marshes, aspen groves, and minor streamsides (not mapped by TRPA as SEZs)--are among the most valuable wildlife habitat in the basin. These relatively undisturbed lands provide valuable wildlife habitat, particularly for medium-sized mammals such as pine martens, aplodontia, and wolverines. Lands above 7,000 feet are considered critical habitat for furbearers. Wintering bald eagles frequent the Lake Tahoe Basin shoreline. Since most of these habitats are in national forest lands where there are few private holdings, adverse impacts of development, would be buffered.

Although the immediate osprey nesting area is in relatively protected state parks, removal of suitable habitat and food sources or excessive disturbance by human activities, especially under Scenarios 2 and 5, will discourage further nesting.

In California all rare and endangered plants except Rorippa subumbellata grow on public lands, which are assumed to be protected from development. Rorippa

subumbellata, which has been found in commercial shoreline areas, could be destroyed unless preservation actions are taken. In Nevada rare or endangered plants have been found on public and private lands. Rorippa subumbellata has been found near a residential subdivision; this plant site should be preserved. Plant sightings in the northern part of the basin have been in private land holdings.

Of the six designated natural areas in the Lake Tahoe Basin, four are in public ownership (Desolation Wilderness, D.L. Bliss, Emerald Bay, and Sugar Pine Point state parks). The Sphagnum bog at Grass Lake is on national forest land. Half of Osgood Swamp is in national forest; half is privately owned.

A small community of alpine plants on the ridgetops of the eastern rim of the basin is not likely to be affected by development in the basin.

Under Scenarios 1 and 4, as the level of development in the STPUD area increases, SEZs around the state line, Tahoe Keys, and the northern part of Montgomery Estates would be most severely affected. Under Scenario 3, SEZs in the northern part of Bijou, Tahoe Paradise would also be subject to development pressures. The affected SEZs in the DCSID area are predominantly in the Kingsbury area.

In addition to eliminating valuable wildlife habitat, development in SEZs would result in soil erosion, vegetation removal, and land disturbance--in proportion to the amount of development. Urban runoff, sedimentation, and nutrient input from erosion would decrease the value of the aquatic habitat, cause a decline in fish population, and accelerate eutrophication in Lake Tahoe. Drainage and infilling would destroy fish spawning and waterfowl nesting habitats. All of these impacts have the further effect of diminishing the natural beauty of the basin and its attractiveness as a recreational area.

Critical Implications

Alteration of specialized habitats, even in seemingly minor ways, can adversely affect the vigor of a threatened plant population. Construction of residential and vacation homes and recreational use can destroy critical plant habitat and eliminate plants. Increased recreational use of meadows and sphagnum bogs disrupts the shallow of moist soil and native vegetation and disturbs wildlife. Increased clearing and development of forested areas will remove old growth trees and snags, important specialized habitat for many wildlife species.

Wolverine are sensitive to human activity in their habitat, and intrusions into wilderness areas can adversely affect population levels of this rare animal.

Nesting osprey can be adversely affected by removal of existing or potential nest sites, increased predation, disturbance from human activities, and reduction of fish populations in Lake Tahoe.

Seasonal bald eagle populations may be adversely affected by population increases through disturbance and removal of actual and potential habitat.

Critical damage would occur to SEZs under all scenarios, especially under Scenarios 2 and 5 in STPUD and Scenarios 4 and 5 in DCSID. If development patterns occur as estimated for Scenario 3, serious impairment of fish spawning and waterfowl nesting habitat can be expected, as half of all SEZs in the south shore area would be converted to urban uses. Urban development and other human activities have already degraded important fish habitats, directly reduced fish populations, and eliminated most of the critical waterfowl nesting habitat in the Lake Tahoe Basin and particularly in the Truckee Marsh.

MITIGATION MEASURES

1. Inventory, monitor, and, if necessary, control recreational use of meadows, bogs, aspen groves, and other valuable moist habitats in accordance with guidelines and management plans of the U.S. Forest Service and state departments of fish and game to protect valuable and rare or endangered plants and wildlife.

Description. All designated natural areas should be protected from non-compatible uses. Recent studies that consider the effect of recreation on remote lands in the Lake Tahoe Basin include the Lake Tahoe Basin Management Unit Land Management Plan, Phase II; the EIS prepared for the plan; and the RARE II inventory. Recommendations and findings in these reports should serve as a basis for identification, retention, and protection of valuable wildlife habitat in the basin.

Effectiveness. Would vary with alternatives and options selected and with implementation. Could be highly effective, depending on detail of inventory, frequency of monitoring, and effectiveness of controls.

Responsibility. U.S. Forest Service, California and Nevada departments of fish and game, TRPA.

Cost. Would depend on the recommendations.

Timing. As soon as possible for natural areas.

2. Protect active osprey nests from disturbance.

Description. On public lands, active nests can be protected by prohibiting clearing, construction, or public recreational use within 1/8 mile (660 feet) of any active nest tree from April 1 to September 15. Other prohibited activities may be identified in a monitoring program. Quality and availability of existing nest sites near the active nest and elsewhere in the basin should be enhanced by a) marking and preserving of good nest trees; b) modifying snags or trees by topping or other action to create new nest sites; and c) erecting artificial nest platforms at the edge of the lake or in shoreline areas where sufficient inland buffer exists.

Effectiveness. Highly effective. Suitable nesting habitat is often the critical limiting factor controlling osprey breeding, and artificial platforms are acceptable to osprey. May slightly modify timber management or development plans, and may limit recreational use of certain lands.

Responsibility. U.S. Forest Service, California and Nevada departments of fish and game, TRPA, and other local land use control agencies.

Cost. Would depend on magnitude of program.

Timing. As soon as possible and management of habitats would be year-round.

3. Require surveys of rare and endangered plants for development proposals, and require measures to minimize impacts.

Description. A survey of known rare and endangered plant populations should be made to determine the status of plants and threats to habitat. This survey could be used as a master evaluation, indicating areas where more detailed study should be undertaken. Individual development proposals could then be required to include site-specific surveys as determined by the master evaluation, and developers would be required to minimize impacts through careful site selection and design.

Effectiveness. Most effective way of dealing with development. Transplantation of unique plants is rarely successful because of narrow habitat requirements and cannot be considered an effective mitigation measure.

Responsibility. In California, TRPA, U.S. Forest Service, Department of Fish and Game (with cooperation of California and Nevada native plant societies); in Nevada, Bureau of Land Management.

Cost. May be borne in part by developer.

Timing. As soon as possible.

4. Require construction and maintenance projects to include measures to protect vegetation and habitat.

Description. Construction and maintenance of homes, roads, and other structures should follow guidelines established by a qualified professional so that poor construction and management practices that result in root compaction and trunk and bark damage may be minimized. Building sites and structure design that minimize vegetation removal, habitat interference, and erosion should be employed. For areas in private ownership, purchase, easement, long-term lease, sale of development rights, or other arrangements may be required to ensure protection and control.

Effectiveness. With adequate controls, highly effective; moderately effective in minimizing impacts of new development.

Responsibility. TRPA, U.S. Forest Service.

Cost. Would vary with lands involved and types of arrangements; may be borne by developer.

Timing. As soon as possible.

SEZs

5. Implement a SEZ ordinance or a similarly restrictive land use control measure to restrict development in SEZs.

(See mitigation measures under "Water Resources and Water Quality.")

6. Implement erosion control standards for all new development projects.

(See mitigation measure under "Water Resources and Water Quality.")

3. NOISE

EXISTING CONDITIONS

Both natural and man-made sounds contribute to the ambient noise environment in the Lake Tahoe Basin. Sounds from man's activities are likely to increase as development of the basin increases, and their levels vary with the location, time of day, and the season. High traffic volumes typical of the south shore area produce continuous noise. Noises from aircraft, motor boats, and recreational vehicles occur intermittently and are of short duration. During the winter, the sounds of snow-chained vehicles and snowmobiles are heard in the backcountry and ski resorts; during the summer, the roar of power boats is heard along the lakeshore. The following sections more fully characterize the man-made sources of noise.

To give some context for the discussion of noise levels in the basin, typical minimum noise levels for different land use areas are shown below:

Land Use	Minimum Ambient Noise Level (dBA) (daytime/nighttime)
Rural	35/30
Suburban	40/35
Urban	45/40
Commercial	50/45
Industrial	55/50

Source: Laymon H. Miller, lecture notes on noise and vibration control for mechanical and electrical equipment in building and noise in manufacturing plants, 1970.

Vehicular Traffic

Vehicular traffic is the most pervasive source of noise in the basin and is the dominant source of ambient noise in areas adjacent to U.S. 50 and Highway 89. Highway noise increases as the number and average speed of vehicles increase. Traffic volume greater than 20,000 vehicles per day, as occurs along U.S. 50

between Meyers and the stateline on busy summer days, produces average noise levels in excess of 70 dBA within 100 feet of the center line of the roadway. Along other roadways within the basin where traffic volumes are much lower, traffic moving at 45 miles per hour still produces average noise levels in excess of 60 dBA within 100 feet of the middle of the road. Besides volume, the type of vehicle and the roadway conditions are major determinants of noise levels. The dominant source of noise is automobile traffic. Heavy-duty diesel trucks account for a negligible 2 percent of total traffic during peak traffic conditions, but in off-peak hours, truck noise becomes much more noticeable.

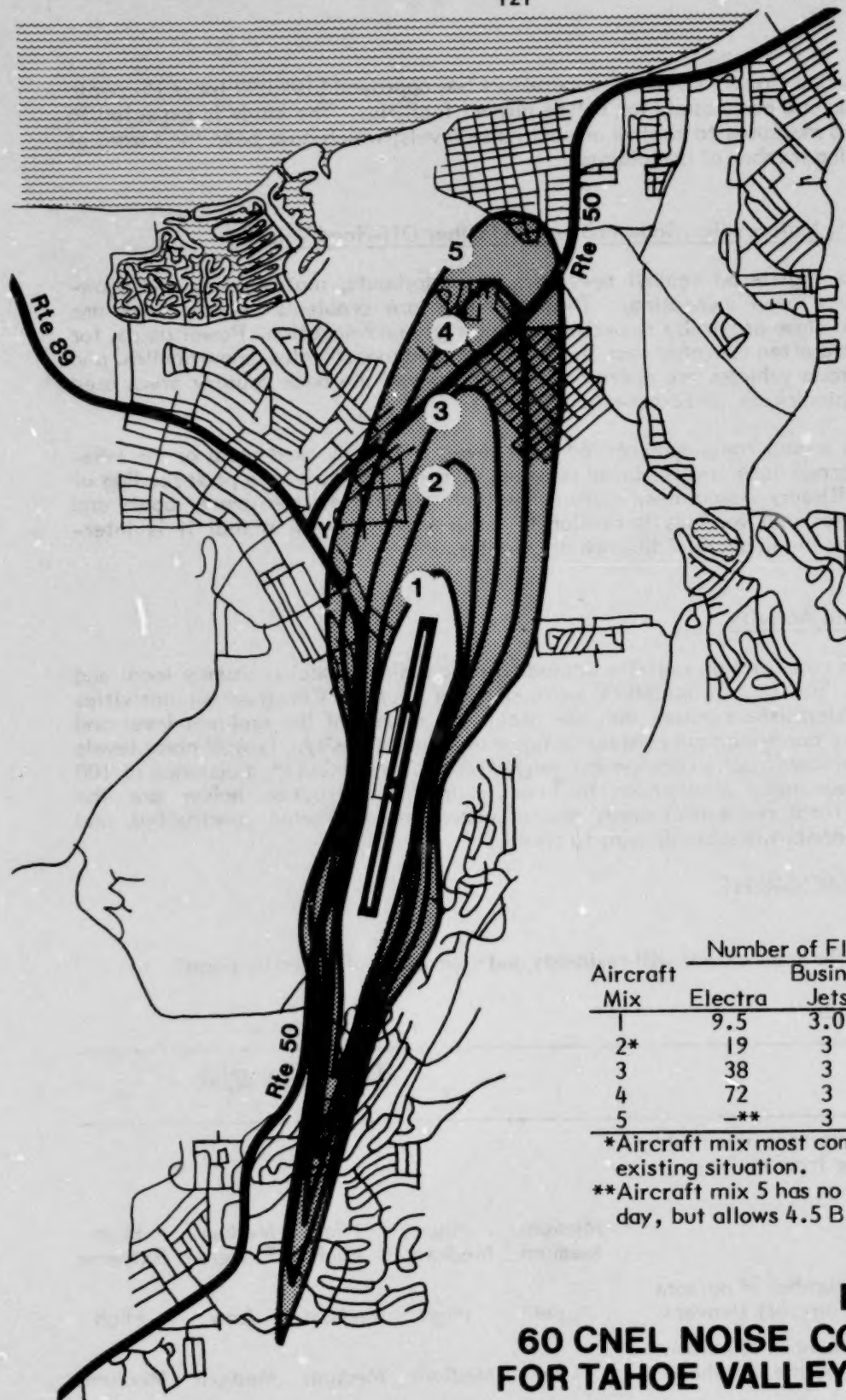
Surveys conducted by the El Dorado County Planning Department in 1978 indicate that as many as 1,200 people live in areas exposed to noise levels above 60 CNEL. (The 60 CNEL contour has been adopted by CTRPA in its 1977 Regional Transportation Plan as the maximum level compatible with the unique, natural beauty of the basin.) Many of these people live in summer tract areas along U.S. Highway 50 and Highway 89 along the west shore of Lake Tahoe. The 1,200 figure includes only residents and does not account for the many visitors who would also be affected. No contours of traffic-related noise levels have been prepared other than those done for the intersection of U.S. Highway 50 and Highway 89.

Aircraft

The Tahoe Valley Airport is the main commercial airport serving the south shore area. The airport lies parallel to U.S. Highway 50, southeast of the intersection of U.S. Highway 50 and Highway 89. Approaching and departing aircraft pass over many residences and businesses to the north and south of the airport. Areas under flight patterns to the north include: Al Tahoe, Country Cross Roads, West Sierra Tract, South Tahoe "Y", Tahoe Keys, and Upper Truckee Marsh. Areas to the south of the airport include: Tahoe Paradise, Country Club Heights, and Meyers. In 1976 aircraft noise measurements taken from Al Tahoe revealed peak sound levels of 88 dBA for takeoffs and 85 dBA for landings. These levels are a significant increase over the existing noise conditions and can cause general annoyance and interruption of speech communication.

Noise contours for various mixes of aircraft were recently prepared by CTRPA and the California Office of Noise Control (see Figure 11). About thirty-four residences lie within the 60 CNEL contour, which corresponds to aircraft mix no. 2. Twenty-four of the affected residences are north of the airport along Melba Drive, Kyburz, and U.S. 50 in Tahoe Valley. The other ten residences are south of the airport in the northern section of Meyers (CTRPA, 1978b).

The outcome of a suit filed by the California Supreme Court on behalf of CTRPA against a recent decision of the California Public Utilities Commission (PUC) to allow unlimited flights by Pacific Southwest Airlines and Air California will greatly affect noise levels from airport operations. The suit charges that the PUC granted the airlines permission to make unlimited flights without CTRPA approval, that the flight paths of planes violate wilderness area solitude rules, and that the PUC environmental impact report did not adequately consider the impacts of not setting a limit on the number of flights. A decision in CTRPA's favor would also reduce the airlines to one roundtrip flight per day between them to the airport rather than the present 21 roundtrips per day (as of May 1979, Pacific Southwest Airlines halted its commercial air service to Lake Tahoe).



Aircraft Mix	Number of Flights/Day		
	Electra	Business Jets	General Aviation
1	9.5	3.0	125
2*	19	3	140
3	38	3	140
4	72	3	140
5	—**	3	125

*Aircraft mix most comparable to existing situation.

**Aircraft mix 5 has no electra flights/day, but allows 4.5 B 727 flights/day.

Figure 11
60 CNEL NOISE CONTOURS
FOR TAHOE VALLEY AIRPORT

The El Dorado County Board of Supervisors has approved \$104,000 for a 15-month master plan and noise study for future airport facilities. The study is expected to recommend measures to control airport noise levels, which have been the target of an increasing number of complaints.

Motorboats, Motorcycles, Snowmobiles, and Other Off-Road Vehicles

Complaints registered against operators of motorboats, motorcycles, and snowmobiles have been increasing. These vehicles are problems because they are operated in close proximity to people seeking rest and relaxation. Power boats, for instance, are often operated near the lakeshore, and motorcycles, snowmobiles, and other off-road vehicles are operated in meadows and the back country areas used by hikers, picnickers, and cross-country skiers.

An EIR for a boat ramp documented noise levels in heavily used areas of the lakeshore. Average noise levels ranged between 60 and 75 dBA, with a peak reading of 88 dBA (Pillsbury Associates, 1974). The high noise level from power boats and other recreational vehicles is similar to noise from aircraft in that it is intermittent, and the impacts of the two are similar.

Construction Activity

Noise from construction activity (including road maintenance) is usually local and temporary, but it can interfere with sleep or work. Construction activities generate intermittent noises that are greatly in excess of the ambient level and usually more annoying than continuous noise of equal intensity. Typical noise levels produced by construction equipment range from 65 to 100 dBA at a distance of 100 feet. Areas most susceptible to impacts from construction noises are the lakeshore, rural residential areas where subdivisions are being constructed, and residences and businesses adjacent to roads.

IMPACT ASSESSMENT

Question: To what extent will residents and visitors be affected by noise?

Measurements

	<u>Growth Scenarios</u>				
	1	2	3	4	5
Increase in persons affected by traffic noise from major roadways					
STPUD	Medium	High	High	Medium	High
DCSID	Medium	Medium	High	Extreme	Extreme
Increase in number of persons affected by aircraft flyovers	Low	High	Medium	Low	High
Increase in number of persons affected along the lakeshore	Low	Medium	Medium	Medium	Medium
Increase in number of persons affected in outlying areas	Low	High	Medium	Medium	High

Impact ratings were derived by comparing existing noise conditions with conditions likely to occur under the different scenarios. Ratings do not indicate compliance with or violation of state or federal standards. It was assumed that an increase in annual visitor days would be accompanied by a proportional increase in the number of snowmobiles, motorcycles, and off-road vehicles in use and the number of campers, hikers, etc.

It was also assumed that as population density increases in areas around the airport along heavily traveled roads, along the lakeshore, and near the backcountry, meadows, and urban fringe, the number of residents or users exposed to a given noise level would increase.

Description

The impacts of noise generated by traffic are primarily a function of the traffic volume and speed. Because traffic volumes are already frequently near peak conditions, increased traffic would not increase noise levels significantly. This is not to say that noise is not a problem, as a measurement of 70 dBA is unacceptable in residential and commercial areas. Traffic-related noise impacts under the scenarios would be very similar for the two sewer districts. The primary difference would occur under Scenarios 4 and 5, where the number of commuters between the basin and Carson Valley would increase substantially. The additional traffic volume could have adverse impacts on residences and businesses along Kingsbury Grade, where much of the development would occur.

The number of persons affected by aircraft noise relates directly to the intensity of development in the areas north and south of the airport. Scenarios 2 and 4 call for full buildout of vacant lands in these areas; the moderate growth projected for Scenario 3 calls for roughly 50 percent buildout of areas to the south and 65 to 100 percent buildout of areas to the north. Consequently, adverse impacts would be expected to increase. Residents and businesses in the DCSID portion of the basin would be largely unaffected.

Construction activity along the lakefront would cause a temporary increase in the ambient noise level. The rise in the noise level would be noticed primarily in the Tahoe Keys area; other areas along the southern and eastern shores would be less likely affected because development opportunities are limited. Lakeshore properties would also be exposed to noise from boating activities, especially under Scenario 5, where overnight visitor days are projected to increase by a factor of 2.0 over 1978 levels.

Areas along the urban fringe have very low background noise levels. Most of these areas are zoned for low density, and continued development would not cause drastic increases in the ambient noise level except during construction. However, as residential neighborhoods spread outward, they would come into closer proximity with areas enjoyed by hikers and snowmobiles. Accordingly, under Scenarios 2 and 5, where development activity and visitor levels would be high, adverse impacts associated with development of the urban fringes may be somewhat greater.

Critical Implications

Traffic noise levels increase by about 4 decibels for every doubling of traffic volume. On already heavily traveled roadways, increases in traffic volume on the

order of those projected under "Transportation" (although significant in terms of the effect on congestion) would not result in a measurable increase in noise levels. However, increases in traffic volume on lightly traveled roads or the construction of new roads could cause significant increases in traffic noise levels.

Airport operations are one of the predominant noise concerns in the Lake Tahoe Basin, although the situation has changed somewhat with Pacific Southwest Airline's decision to halt service. Both the level and type of airport service that should be provided are being debated. Additional flights into the basin would increase frequency of exposure to aircraft noise. As development occurs in the basin, particularly in the neighborhoods north of the airport, the number of residences exposed to noise levels greater than 60 dBA would increase far beyond the present number (less than fifty). Expanded airport operations would also adversely affect Barton Memorial Hospital, which now lies within the 65 CNEL contour.

It is difficult to directly correlate environmental noise level with value of property. However, it is obvious that a potential buyer of property would be willing to pay more for property in a quiet setting than for property in an area where noise levels from aircraft and traffic are high. Therefore, the value of homes and home sites would probably be lower where noise exceeds a level of about 55 CNEL.

FHA-financed or insured mortgages are not available in areas where noise levels exceed a level of about 60 CNEL. According to HUD noise and land use compatibility standards, such areas are considered "normally unacceptable."

Excessive noise can affect human psychological and physical health. The more apparent effects include irritability, headaches, and insomnia. Aircraft flyovers and construction noise can cause disruption of daily work routines, diminished enjoyment of the wilderness experience, and interference with speech and hearing.

MITIGATION MEASURES

The noise elements of city and county general plans, as mandated by the state of California (Government Code, Section 65302(g)), should contain statements of general policy concerning noise and noise sources in the community. The plans should also identify desired maximum noise levels by land use categories and standards and criteria to control noise. The following list of mitigation measures should be compatible with the general policy statement and objectives expressed in the noise elements of Placer and El Dorado counties and the city of South Lake Tahoe and with the plans and goals of CTRPA and TRPA. There are no known noise standards or regulations that apply in Nevada, with the exception of those that apply to federally financed road improvements or housing projects.

Recommendations for mitigating airport noises specifically will be developed as part of the Tahoe Valley Airport noise control and land use compatibility study. Implementation of these measures will involve the airlines, the airport director, and the PUC. The main operational restriction on airlines, namely the use of electra turboprop jets only, is already imposed by PUC. Other measures, such as limiting the hours of airport operation and recommending noise abatement takeoff procedures, have already been imposed by the El Dorado County Board of Supervisors and the airport director. Such measures should be continued as a means of controlling noise from airport operations.

1. Draft noise control ordinance for local adoption and enforcement.

Description. The goal of such an ordinance, which would be uniformly adopted by jurisdictions in the basin, would be to establish permissible noise levels based on existing land uses. New noise sources would be allowed, but only if they do not exceed permissible noise levels. A special feature of this ordinance might be a set of restrictions that, where not already covered by the state Vehicle Code or the Harbors and Navigation Code, would govern the time, location and manner of use of noise sources such as snow mobiles. This has already been accomplished in the TRPA Shoreline Ordinance for the operation of power boats.

CTRPA has prepared a draft noise ordinance that proposes noise restrictions on construction and demolition activities at affected properties and maximum exterior noise limits as follows:

- interior noise limits for hospitals - 35 dBA
- residential areas - 35 dBA at night and 45 dBA during the day
- schools - 45 dBA during the day and evening

Effectiveness. Would be highly effective if rigorously enforced. Current California regulations specify maximum noise levels for individual noise sources and encourage noise compatibility land use planning. The local/regional ordinance would complement these efforts by regulating individual noise sources. A noteworthy feature of the ordinance is the duty of the noise control officer to review zoning changes to ensure noise compatibility among land uses and to issue citations for violations of the ordinance. At this point, there has been no effort to adopt the ordinance or to encourage voluntary cooperation among local governments.

Responsibility. Local governments, CTRPA, TRPA.

Cost. According to CTRPA estimates, preparation of the ordinance would cost nearly \$2,000, and first year costs for monitoring and enforcement would be about \$46,000.

Timing. Model ordinance can be drafted immediately with the assistance of the California Office of Noise Control (CTRPA has already prepared parts of such an ordinance).

2. Revise zoning ordinances to prevent incompatible land uses.

Description. This approach would call for the use of zoning to separate noisy land uses, such as airports, from noise sensitive ones, such as residential districts. This can be implemented by excluding incompatible uses from a noise impact area, by permitting cluster development, which enables greater flexibility in arranging land uses and buildings, by downzoning areas likely to be incompatible, or by requiring noise barriers or buffer strips.

Effectiveness. Zoning is already a commonly used local administrative technique to direct land use and would effectively implement CTRPA and TRPA policies for noise compatibility in new development. There are drawbacks, however, that may limit the use of zoning. First, the creation of noise zones may not be consistent with existing land use or development goals. Second, zoning would have to rely on local noise ordinances to prevent uses within the zone from becoming noise nuisances in adjacent zones.

Responsibility. Local governments, CTRPA, TRPA.

Cost. Insignificant, as zoning is already practiced.

Timing. Should be implemented, if compatible with land and regional growth and development plans. Zoning revisions to incorporate noise considerations should be coordinated with update of general and regional plans.

3. Establish special permit procedures to implement noise reduction measures.

Description. At present, under the Noise Insulation Standards of the California Conservation Code, new multi-family housing is subject to standards for exterior noise, insulation, and sound isolation between units. Special permit procedures can be used to require implementation of physical techniques or modification of site plans and construction practices prior to permit approval for single-family units or to enforce more stringent standards. For example, the permit-issuing authority can deny an occupancy permit unless the developer ensures that the building will meet specific noise standards. A number of physical techniques are available, including design of windows, doors, and ceilings, room arrangement, window placement, barriers, walls, and plants.

Effectiveness. Principal advantage is that each situation is treated individually. Appropriate acoustical analysis can easily be incorporated into the existing permit review process. Incorporation of physical techniques during building construction would insulate the inhabitant and minimize the transmission of sound, but would do nothing to reduce noise levels at the source. Accordingly, special permit procedures should complement efforts to reduce noise at the source, but should not be relied upon by themselves to mitigate adverse impacts.

Responsibility. Developer, local governments, CTRPA, TRPA.

Cost. Insignificant, as the implementation and enforcement mechanisms are already in existence. Developer would bear the cost of making the structure acoustically sound.

Timing. Special permit should be implemented as part of the local building permit process. Once substantial development of the basin occurs, the effectiveness of this measure is minor, and it should be implemented or at least considered carefully within the next few years.

4. Construct noise barriers along major highways to reduce noise impacts on residents and visitors.

Description. Noise barriers or berms can be placed along critical segments of major roadways such as U.S. Highway 50. Critical segments include areas where proposed development would have a direct line of sight to the roadway and where the roadway is heavily traveled.

Effectiveness. If the size and length of the barrier is designed to fit the situation, this measure could be effective in minimizing traffic noise. To be effective, the barrier must break the line of sight between the road and development.

Responsibility. Local and state governments.

Cost. Cities and counties can apply for state funds set aside for construction of noise barriers.

4. METEOROLOGY AND AIR QUALITY

EXISTING CONDITIONS

Meteorology

Topography, altitude, and synoptic conditions (the effect of weather conditions beyond the local area) affect weather conditions and air quality in the Lake Tahoe Basin.

Winds are caused by the difference in air pressure between two locations. There are two types of local winds produced in the Lake Tahoe Basin. The first type, lake/land breezes, are caused by the pressure differences between Lake Tahoe and the surrounding land mass. During the day, when the land is warmer than the lake, the breeze blows from the lake to the shore at a speed of 2 to 4 meters per second. During summer evenings and in winter whenever the land is cooler than the lake, breezes blow from the land to the lake at a speed of 1 to 4 meters per second. The second type of local wind occurs in the mountains and valleys. During the day, the valley floor and the air above it warm up. This warm air, less dense than the colder air higher up, moves up the slope, creating a valley wind. In the Lake Tahoe Basin, these winds blow at speeds of 1 to 4 meters per second. The opposite occurs at night, as mountain or drainage winds blow down-slope at speeds of 0.5 to 2 meters per second.

Local winds occur 25 to 40 percent of the time in the Lake Tahoe Basin and are most prevalent under clear skies and weak synoptic conditions. (Twiss, 1971; CARB, 1974). The mountain/valley winds and lake/land breezes interact with each other throughout the basin to produce a radial outflow of air from the center of the basin during the day and a radial inflow at night. At night, the wind speeds are low, and pollutants are ineffectively dispersed. Speeds during the day are normally higher, but periods of poor dispersion still occur. In areas near well-defined valleys (e.g., Christmas Valley and Truckee River Valley), winds blowing through the valley are prominent.

During periods when the local winds are not dominant, north winds are most common due to the influence of the semi-permanent Pacific high. On cold winter days, the north winds can blow relatively warm air from the lake up and over cool surface air, thus creating an "inversion" over the south shore area. Inversions affect air quality by hindering the mixing of pollutants and can result in high pollutant concentrations. During storm periods, the synoptic influence is dominant, and moderate to strong winds ventilate the basin, minimizing pollutant concentrations.

The Lake Tahoe Basin topography and altitude contribute to the formation of stable layers and a high air pollution potential. After sunset cool air is drained into the basin floor by mountain winds, and heat energy escapes through the dry, "thin" air, creating strong ground-based stable layers (inversions). On the average, inversions form during 20 to 30 nights per month for the months of June through October, with inversion depths averaging between 150 and 400 feet. These stable layers are characterized by light winds and limited vertical mixing. Under these conditions, pollutants become trapped and high concentrations result. During the day, solar heating causes vertical mixing of the lower atmosphere, which enables pollutants to

mix in a larger volume of air and thereby reduces concentrations. The presence of cloud cover will hinder the formation both of the nocturnal stable layer and the daytime mixing layer.

Because of its high altitude, the Lake Tahoe Basin receives a high level of solar energy, and the photolysis rate (the rate of chemical decomposition caused by sunlight) and the production of photochemical pollutants are increased. This can also result in the production of haze and the reduction of visibility.

Most annual precipitation (55 to 75 percent) in the Lake Tahoe Basin falls from December through March as snow. More than half of the winter precipitation falls during 12 to 14 nonconsecutive days (Twiss, 1971). As a result, air quality is only minimally improved by pollution wash-out, particularly as the important pollutants (e.g., ozone) either do not form during precipitation conditions or are gases (e.g., carbon monoxide) unaffected by precipitation.

Air Quality

Lake Tahoe Basin Nonattainment Plan. Federal and state activities related to air quality have been authorized by several pieces of legislation, the most important of which are the 1970 and 1977 amendments to the Clean Air Act. The 1970 Clean Air Act amendments required each state to develop and adopt a plan to achieve, maintain and enforce the National Ambient Air Quality Standards (NAAQS) by 1975 (for primary standards).

The 1977 Clean Air amendments recognized the fact that most of the major urban regions of the country failed to attain the primary NAAQS within the set deadlines. The new amendments required all states and EPA to identify areas that meet all NAAQS, areas that exceed any of the standards, and areas where adequate ambient air quality monitoring data is lacking. The California and Nevada sides of the Lake Tahoe Basin have been designated as "nonattainment areas" with respect to oxidant and carbon monoxide.

Due to this designation, the Lake Tahoe Basin is responsible for the development of a nonattainment plan (NAP) to bring down the levels of two pollutants to the required standards. The Congressional deadline for attainment of the NAAQS is December 31, 1982, but states with severe oxidant or carbon monoxide problems may have until 1987 provided that a number of specified conditions are met.

The preparation of the NAP for the basin is complicated by existing political boundaries. Though the Lake Tahoe Basin is a single unit geographically; politically it falls under two separate air quality control regions. The California side of the basin is part of the Sacramento Valley Air Quality Control Region, and the Nevada portion is a part of Air Quality Control Region 148. In selecting the lead agency to prepare the NAP, Nevada designated TRPA while California selected the California Air Resources Board (ARB).

Despite the disagreement over lead agency responsibilities in the region, there was agreement on the need for coordination in plan development and recognition of the problem as regional. Therefore, TRPA and ARB committed themselves to a coordinated program of plan development. The vehicle for this effort is the Ad Hoc Air Quality Committee formed jointly by ARB and the Nevada Division of Environmental Protection in 1976.

In late 1977, when it became apparent that the Lake Tahoe Basin would fall under the nonattainment provisions of the Clean Air Act, the Ad Hoc Committee began organizing technical data for the NAP. With all this effort already under way by the time the two lead agencies had been designated, it was logical that these agencies should rely upon the Ad Hoc Committee as the principal source of technical data for the plan.

The contents of the Draft Lake Tahoe Basin NAF for both California and Nevada include:

- a base year (1977) emission inventory, which identifies the major emission sources among stationary and mobile sources and which is a major component of the air quality models that determine the amounts of emission reductions necessary to meet the NAAQS
- an emission forecast analysis adjusted to reflect summer and winter inventories for the projected years of 1982, 1987 and 1995
- an air quality analysis and trends forecast developed through the monitoring of existing air quality and the existing knowledge of demographic and travel characteristics, as well as past, current and future land use policies. (Two alternative growth scenarios (high and low growth) were developed to facilitate comparison of the relative impacts of differing growth levels on air quality for the years 1982, 1987 and 1995.)
- an analysis through oxidant and carbon monoxide modeling techniques of the estimated reductions necessary to attain air quality standards.

Air Quality Standards and Monitoring. Air quality standards for the Lake Tahoe Basin are listed in Table 29. When discrepancies between the California and Nevada standards occur, the standard for the state in which the receptor (monitoring equipment) is located is used for evaluating air quality. Air quality problems in the Lake Tahoe Basin concern levels of carbon monoxide and oxidant. Carbon monoxide is a highly toxic gas that is a normal byproduct of incomplete fossil fuel combustion. Oxidants, which are principally composed of ozone, are oxygen-containing substances that react chemically in the air to contribute to photochemical smog. Ozone is a pungent, colorless, toxic gas.

The Lake Tahoe Basin is considered a nonattainment area for carbon monoxide (CO) (Nevada Dept. of Conservation and Natural Resources, 1977). In 1977 the 8-hour CO standard of 6 parts per million (ppm) was equalled or exceeded 156 times at the Nevada monitoring station in Stateline. At the nearby California Air Resources Board (ARB) site on Park Avenue, however, no violations were recorded during the same period and, in fact, the 8-hour CO average concentration was greater than 2 ppm only four times during the year. (The difference between these two monitoring stations can be explained by the 10 meter (m) height at the intake of the ARB station monitor. Consequently, the ARB monitor is an inappropriate measure of the concentrations to which the public is exposed.)

An intensive period of CO monitoring in the vicinity of the Park Avenue and Highway 50 intersection in South Lake Tahoe was conducted by Caltrans in February 1978 (Baker, pers. comm.). Frequent violations of the 8-hour CO standard were observed. In addition, a 1-hour CO concentration of 31 ppm was measured at a receptor 3 meters from Park Avenue and 5 meters from Highway 50. This value is close to the 1-hour Nevada standard (35 ppm).

Table 29 AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	California Standards ¹		Nevada Standards ¹		National Standards ²		
		Concentration ³	Method ⁴	Concentration ³	Method ⁴	Primary ²	Secondary ²	Method
Oxidant (Ozone)	1 hour	0.10 ppm ³ (200 ug/m ³)	Ultraviolet Photometry	235 ug/m ³ (0.12 ppm)	Ultraviolet Photometry or Chemiluminescent Method	235 ug/m ³ (0.12 ppm)	Same as Primary Standard	Chemiluminescent Method
Carbon Monoxide	12 hour	10 ppm (11 mg/m ³)	Non-Dispersive Infrared Spectroscopy (NDIS)	—	—	—	Same as Primary Standards	Non-Dispersive Infrared Spectroscopy
	8 hour	—		10 mg/m ³ (9.0 ppm)	Non-Dispersive Infrared Spectroscopy (NDIS)	10 mg/m ³ (9 ppm)		
	1 hour	40 ppm (46 mg/m ³)		40 mg/m ³ (35 ppm)	—	40 mg/m ³ (35 ppm)		
Nitrogen Dioxide	Annual Average	—	Saltzman Method	100 ug/m ³ (0.05 ppm)	Proposed: Modified J-H Saltzman (O ₂ corr.) Chemiluminescent	100 ug/m ³ (0.05 ppm)	Same as Primary Standards	Proposed: Modified J-H Saltzman (O ₂ corr.) Chemiluminescent
	1 hour	0.25 ppm ³ (470 ug/m ³)		—		—		
Sulfur Dioxide	Annual Average	—	Conductimetric Method	60 ug/m ³ (0.02 ppm)	Conductimetric Method	80 ug/m ³ (0.03 ppm)	—	Pararosaniline Method
	24 hour	0.05 ppm ³ (131 ug/m ³)		260 ug/m ³ (0.1 ppm)		365 ug/m ³ (0.14 ppm)	—	
	3 hour	—		1,300 ug/m ³ (0.5 ppm)		—	1300 ug/m ³ (0.5 ppm)	
	1 hour	0.5 ppm ³ (1310 ug/m ³)		—		—		
Suspended Particulate Matter	Annual Geometric Mean	60 ug/m ³	High Volume Sampling	60 ug/m ³	High Volume Sampling	75 ug/m ³	60 ug/m ³	High Volume Sampling
	24 hour	100 ug/m ³		150 ug/m ³		260 ug/m ³	150 ug/m ³	
Sulfates	24 hour	25 ug/m ³	AIHL Method No. 61	—	—	—	—	—
Lead	30 Day Average	1.5 ug/m ³	AIHL Method No. 54	—		—	—	—
Hydrogen Sulfide	1 hour	0.03 ppm ³ (42 ug/m ³)	Cadmium Hydroxide Straction Method	—	—	—	—	—
Hydrocarbons (Corrected for Methane)	3 hour (6-9 a.m.)	—	—	160 ug/m ³ (0.24 ppm)	Flame Ionization Detection Using Gas Chromatography	160 ug/m ³ (0.24 ppm)	Same as Primary Standards	Flame Ionization Detection Using Gas Chromatography
Ethylene	8 hour	0.1 ppm	—	—	—	—	—	—
	1 hour	0.5 ppm		—		—		
Visibility Reducing Particles	1 observation	In sufficient amount to reduce the prevailing visibility ⁵ to less than 10 miles when the relative humidity is less than 70%		—	—	—	—	—

APPLICABLE ONLY IN THE LAKE TAHOE AIR BASIN

Carbon Monoxide	8 hour	6 ppm (7 mg/m ³)	NDIS	6,670 ug/m ³ (6.0 ppm)	NDIS	-	-	-
	1 hour	-		40 mg/m ³ (35 ppm)		-	-	-
Visibility Reducing Particles	1 observation	In sufficient amount to reduce the prevailing visibility to less than 30 miles when the relative humidity is less than 70%		-	-	-	-	-

NOTES:

¹ California standards are values that are not to be equaled or exceeded. Nevada standards are values that are not to be exceeded where the general public has access.

² National standards, other than those based on annual averages or annual geometric means, are not to be exceeded more than once per year.

³ Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 mm of mercury. All measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 mm of Hg (1,013.2 millibar); ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

⁴ Any equivalent procedure which can be shown to the satisfaction of the Air Resources Board for California or the Environmental Protection Services for Nevada to give equivalent results at or near the level of the air quality standards may be used.

⁵ National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

⁶ National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

⁷ Reference method as described by the EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the EPA.

⁸ Prevailing visibility is defined as the greatest visibility which is attained or surpassed around at least half of the horizon circle, but not necessarily in continuous sectors.

*Applies only on days when either the California 1-hour oxidant standard or the California 24-hour suspended particulate standard is violated at the sulfur dioxide monitoring location.

Carbon monoxide concentrations vary both annually and diurnally in the Lake Tahoe Basin. At the Nevada Stateline monitoring site in 1977, the highest daily peak 8-hour CO average (for a three month period) occurred for the January to March quarter (5.2 ppm). The fall quarter (October-December) was second highest with an average value of 4.6 ppm. The spring and summer quarters were similar at 3.8 ppm and 3.7 ppm, respectively. The most frequent inclusive hours resulting in the daily peak CO concentration were 12 midnight to 8 a.m. in winter (January-March), 2 a.m. to 10 a.m. in fall, 9 p.m. to 5 a.m. in spring, and 12 noon to 8 p.m. in summer.

In December 1977, the Lake Tahoe Basin was classified as a nonattainment area for oxidants (Nevada Department of Conservation and Natural Resources, 1977). The air quality standard is stated in terms of oxidants, but the monitoring procedure is specific to ozone, the principal constituent of oxidants. Nevada has recently relaxed its 1-hour oxidant standard from 8 pphm to 12 pphm except in the Lake Tahoe Basin, where the standard was changed to 10 pphm in order to be consistent with California's standard. At the same time, the federal standard has also been relaxed to 12 pphm. The lower standards may result in the reclassification of the basin as an attainment area for ozone, although data collected in August 1978 by the California ARB recorded a 1-hour oxidant level of 10 pphm in South Lake Tahoe, which violates the local standard. The source of the local oxidant problem is uncertain, since only low levels of non-methane hydrocarbons and nitrogen dioxide (the precursors to the formation of ozone) are observed. Therefore, the problem is not believed to be from local or man-caused sources. Two possible sources have been identified: the Sacramento area and the natural stratospheric ozone (in the lee waves of the Sierra).

IMPACT ASSESSMENT

Question: How will air quality be affected?

Measurements

	1978	1	2	Growth Scenarios		5
				3	4	
Carbon monoxide (CO)						
concentration* in South						
Lake Tahoe at Stateline (ppm)						
Local CO component	-	6.3	7.1	8.1	7.9	9.1
Background CO component	-	0.8	0.8	0.8	0.8	0.8
Total CO concentration	24.3	7.1	7.9	8.9	8.7	9.9
Impact rating	-	Low	Medium	High	High	Extreme
CO concentration* in South						
Lake Tahoe at Al Tahoe (ppm)						
Local CO component	-	5.9	7.0	7.6	7.2	8.3
Background CO component	-	1.1	1.2	1.2	1.2	1.3
Total CO concentration	20.9	7.0	8.2	8.8	8.4	9.6
Impact rating	-	Low	Medium	High	Medium	Extreme

	1978	1	2	Growth Scenarios		5
				3	4	
CO concentration* in Tahoe City (ppm)	2.4	2.2	2.2	2.2	2.2	2.2
Impact rating		None	None	None	None	None
CO concentration* in Crystal Bay (ppm)	5.4	3.0	3.0	3.0	3.0	3.0
Impact rating		None	None	None	None	None
Peak basinwide ozone (O ₃) concentration (pphm)** ³	10	<8	<8	<8	<8	<8
Impact rating		Very Low	Very Low	Very Low	Very Low	Very Low

* 8-hour average value

** peak value

The carbon monoxide and ozone impacts summarized above reflect an assessment of current conditions (i.e. air quality, meteorology, and emissions), a projection of the emission changes likely to accompany each of the growth scenarios, and the application of numerical simulation models to estimate air quality changes. In the case of CO, microscale and mesoscale dispersion models were applied to simulate local and areawide effects; a kinetics model was used to quantify the photochemical production of ozone. In all cases, the projected impacts are based on worst-case conditions. Because the various models were used to predict future air quality conditions, the applicability of the methods was tested on the basis of current measurements.

The impact ratings are based on a comparison of predicted concentrations to existing ambient air quality standards in the basin. The standards used were 6 ppm on an 8-hour averages basis for CO, and 10 pphm for the peak 1-hour value of ozone. CO levels above 9 ppm were labeled "extreme" in that they represent a 50 percent exceedance of the 8-hour standard. "Low," "medium" and "high" were used to describe levels increasing from the standard to "extreme". A rating of "very low" indicates a concentration peak that is a significant fraction of the standard, yet does not endanger the standard; "none" indicates that the value is not a significant fraction of the standard and will not create adverse impacts. Analyses was based on special field studies which do not provide sufficient data to give average number of days of violations to the expected.

The 8-hour CO averages projected by the calculations apply to "hot-spot" locations that have only been surveyed by special studies like the 1978 Caltrans study mentioned earlier. Neither the California ARB routine monitor at Park Avenue nor the Nevada Department of Environmental Protection monitor in Stateline are sited to monitor hot-spot conditions; rather they are more indicative of areawide background levels (although the latter does record some high levels).

Description

Carbon monoxide problems are usually associated with high traffic demand volumes and/or low vehicle speeds (and corresponding high emission rates). The four locations used in the CO analysis typify the range of variations in road and traffic conditions throughout the basin. Conditions typified by the two north shore communities are not expected to have any adverse air quality impacts under any of the five growth scenarios. Conditions along Highway 50 on the south shore, where traffic is highly concentrated in narrow corridors, are expected to have varying degrees of adverse air quality impacts under all of five scenarios.

The projections assume major decreases in per-vehicle emission rates (e.g., in the year 2000, idle emission rates for CO are but 13 percent of 1978 rates; at 20 mph they are only 29 percent), and yet violations of the standard are still projected to occur under all scenarios. In fact, violations as much as 65 percent above the standard are expected. The continuing violations can be attributed to the increasing traffic volumes at the hot spot locations. As the two monitoring sites typify peak traffic conditions along the south shore, other locations along Highway 50 probably have similarly high CO concentrations.

In addition to representing the assumed worst-case conditions for traffic and meteorology, the projected CO levels are also specific to the location of the hypothetical receptor where the measurements were made. Although the receptor locations are in accordance with guidelines for siting monitoring equipment, other locations closer or more removed from the nearby roads would also be acceptable. Accordingly, moving the receptors closer would seem to exacerbate the problem and moving them further away would seem to ameliorate the problem.

No ozone problems are anticipated in the year 2000 under any of the growth scenarios. The reasons are twofold: first, the ambient air quality standard for ozone has recently been raised from 8 to 10 pphm, and second, the peak-value for ozone of 10 pphm in 1978 would drop to less than 8 pphm in 2000 under all of the five scenarios (on the basis of emissions, as described earlier).

Critical Implications

Although the worst of the worst-case conditions for the year 2000 is markedly improved over 1978 conditions (CO concentrations are 9.9 and 24.3 ppm for an 8-hour average in the two years, respectively) standards at south shore locations typified by the sites at Park Avenue and Al Tahoe will continue to exceed the 8-hour ambient air quality standard under all five alternative growth scenarios. Under Scenario 1, the 6-ppm standard would be exceeded by 1 ppm during worst-case conditions; under Scenario 5, the standard would be exceeded by almost 4 ppm at both sites. Under Scenarios 2 through 4, levels would fall between these two limits.

MITIGATION MEASURES

The mitigation measures needed to minimize adverse impacts from the five alternative growth scenarios are identified in the draft Lake Tahoe Basin NAP. They fall into three categories: transportation, land use planning, and stationary source.

NONATTAINMENT PLAN

CONTROL MEASURE		ADOPTION/COMMITMENT							LEAD AGENCY AND DATE OF IMPLEMENTATION	
		Ad Hoc	SLT	E.D.CO.	CTRPA	TRPA	CALTRANS	ARB		
TRANSPORTATION MEASURES										
1.	Inspection/Maintenance	A	A	A	A	A	S	A	State, local governments; 1982*	
2.	Reduce Cold Start Conditions	R	FS	FS	A	FS	-	FS	Local governments; 1980	
3.	Gaseous Fuel Conversion	R	R	R	A	R	-	R	Federal government, states	
4.	Traffic Flow Improvements	A	A	A	A	A	S	S	State highway departments, local government public works department, private industry; 1980-81	
5.	Reversible Bus Lanes	FS	R	R	A	FS	NS	A	States, local governments; 1982	
6.	Driver Advisories	R	FS	FS	A	A	S	A	Caltrans, states division of highways, state highway patrols, 1979	
7.	Loading Regulations	R	FS	FS	A	FS	S	A	State public works departments, local governments; 1979-81	
8.	Staggered Work and/or Operation Hours	FS	R	A	A	A	S	FS	Governmental and private employers; 1979	
9.	Snow Removal Procedure	A	A	A	A	A	S	A	States, local governments; 1980	
10.	Traffic Movement Control	A	A	A	A	A	-	A	States, local governments; 1982*	
11.	Idling Restrictions (Drive-Up Windows)	A	FS	FS	A	A	-	A	States, local governments, TRPA, CTRPA, 1979*	
12.	Parking Location Control	FS	A w/FS	A w/FS	A	FS	-	A	States, local governments; 1980*	
13.	Parking Supply Management	FS	FS	FS	A	FS	S	FS	States, local governments; 1982*	
14.	Parking Operation	FS	FS	A	A	FS	S	A	Local governments; 1980*	
15.	Peripheral Parking Facilities	FS	R	FS	A	FS	-	A	States, local governments; 1982	
16.	Parking Surcharges	FS	R	R	A	FS	S	FS	Local governments; 1981	
17.	Road Use or Entry Charges (User Fee)	R	R	R	A	R	S	A	States, local governments; after 1982	
18.	Priority Treatment for Carpools	FS	FS	FS	A	FS	S	A	Federal, states, local governments, private sector; 1979	
19.	Increased Vehicle Registration Fees	R	R	R	A	R	-	R	State motor vehicle departments; 1979*	
20.	Bikeways	A	A	A	A	A	S	A	States, local governments; TRPA, CTRPA; 1981*	
21.	Pedestrian Facility	A	A	A	A	A	S	A	States, local governments, TRPA, CTRPA; 1980*	
22.	Roadwork Restrictions	R	A	A	A	A	NS	A	States, local governments; 1979-80	
23.	Mail Delivery	A	FS	A	A	A	S	A	Local governments, U.S. Postal Service; 1980*	
24.	Rail	FS	FS	FS	A	FS	-	FS	Federal, state, local governments; 1982	
25.	Intensive Bus Service	FS	A w/FS	A w/FS	A	FS	S	A	Local governments; 1980	
26.	Free Mass Transit*	FS	FS	FS	A	FS	S	A	Local governments; 1980	
27.	Express Bus Lanes	FS	R	R	A	FS	-	A	States, local governments; 1982	
28.	Employee Mass Transit Incentives	FS	A	A	A	A	S	FS	Local governments, private sector, 1981;	

NONATTAINMENT PLAN (Continued)

CONTROL MEASURE		ADOPTION/COMMITMENT						LEAD AGENCY AND DATE OF IMPLEMENTATION	
		Ad Hoc	SLT	E.D.CO.	CTRPA	TRPA	CALTRANS		ARB
LAND USE AND PLANNING MEASURES									
1.	Zoning Approvals	A	R	R	A	A	-	A	TRPA, CTRPA; 1979
2.	Purchases of Fragile Lands	R	R	R	A	R	-	FS	Federal government, states; after 1982
3.	Subdivision Prohibition	R	R	R	A	R	-	A	Already adopted by CTRPA
4.	Indirect Source Review	A	R	R	A	A	-	A	Already adopted by CTRPA, being considered by TRPA
STATIONARY SOURCE MEASURES									
1.	Service Stations	A	A	A	A	A	-	A	County air pollution control and health districts; Nevada DEP; 1980*
2.	Bulk Storage Plants (Petroleum)	A	A	A	A	A	-	A	County air pollution control and health districts; 1979-80
3.	Architectural Coating	FS	FS	FS	A	FS	-	FS	County air pollution control and health districts; Nevada DEP*
4.	Degreasing Operations	FS	FS	FS	A	FS	-	FS	County air pollution control and health districts; Nevada DEP; 1980
5.	Asphalt Paving	FS	FS	FS	A	FS	-	FS	State, county and city public works departments
6.	Gaseous Fuel Space Heating	R	R	R	A	R	-	FS	Private sector, local government building departments, ARB, Nevada DEP; after 1982
7.	Solar Space Heating	R	R	R	A	A	-	FS	Local governments; 1980*
8.	Forest Management Burning	R	R	R	A	A	-	R	U.S. Forest Service; 1979
9.	Emission Charges	FS	FS	FS	A	FS	-	R	County air pollution control and county health Districts; 1981
10.	New Source Review Role	A	A	A	A	A	-	A	County air pollution control and health districts, Nevada DEP, already adopted by Lake Tahoe Air Basin Council.

* Control measures requiring legislation before they may be implemented.

A Control measures which have been adopted.

FS Control measures which are being further studied.

R Control measures which have been rejected.

S Support

NS Nonsupport

Ad Hoc Air Quality Committee
SLT City of South Lake Tahoe
E.D.CO. El Dorado County
CTRPA California Tahoe Regional Planning Agency
TRPA Tahoe Regional Planning Agency
CALTRANS California Department of Transportation
ARB California Air Resources Board

Source: TRPA, Lake Tahoe Basin Nonattainment Plan, April 1979.

The population projections of the NAP and the EIS are consistent; thus, the mitigation measures listed in the approved NAP would be adequate to address the adverse secondary impacts expected under the alternative growth scenarios which must be considered pursuant to the CEQ regulations.

The Clean Air Act Amendment also established sanctions for failure to meet the required deadline or failure to implement the required plan. The sanctions contained in Section 316 (sewage treatment grants), which authorizes the administrator of the EPA to "withhold, condition, or restrict the making of any grant for construction of sewage treatment work," are of special interest to the region. The sewage treatment systems of both STPUD and DCSID are facing the necessity of major facility improvements just to meet current discharge requirements and/or accommodate moderate increases in development. If the NAP has not been approved by the time a Step 3 grant has been awarded to STPUD or to DCSID, then EPA will negotiate project-specific mitigation pursuant to Section 316.

The above chart from the California and Nevada NAPs includes those measures which have been approved, require further study, or have been rejected. Details on these measures are covered in the NAP. Responsible agencies and schedules for implementation of the adopted measures are also indicated. Asterisks indicate some legal action in the form of an ordinance or resolution is required.

Because changes in air quality brought about by transportation measures can be somewhat quantified, an analysis of necessary speed increases to reduce CO concentrations has been prepared. In order to meet the ambient air quality standard of 6 ppm over an 8-hour average for CO, average vehicular speed at Highway 50 and Park Avenue would have to increase 30 percent (or 1.5 miles per hour) over 1978 speeds for Scenario 1, 40 percent for Scenario 2, 50 percent for Scenarios 3 and 4, and 60 percent for Scenario 5. The necessary speed increases are even greater at Highway 50 and Al Tahoe. The increasingly faster speeds necessary to meet air quality standards at the high growth scenarios suggest that other measures such as reducing traffic demand may be more appropriate.

5. VISUAL RESOURCES

EXISTING CONDITIONS

The visual quality of the Lake Tahoe Basin is one of the main attractions of the region. In the early 1900s, the landscape was predominantly natural, and the area was primarily used for summer recreation by a small number of people able to travel long distances and take long vacations. Man's activities were limited, and major visual intrusions on the landscape did not occur (Scott, 1957). Then, after World War II, when new highways into the Lake Tahoe Basin were constructed, the tourist boom began. Casino development expanded on the Nevada side, and the visual character of the area began to change. Even as late as 1956, however, the area had only 9,500 permanent and summer residents and 36,400 transient tourists (Pagter and Wolfe, 1964). But by 1975, the resident population was 51,200, and the number of persons at one time (PAOT) was estimated at 150,000 (TRPA and U.S. Forest Service, 1978).

Most major visual deterioration has occurred on privately held lands, which are centered around the perimeter of the lake, in most cases along major roadways. Thus, it is the visual character of the area most frequently seen by visitors that has changed most. The average visitor traveling around the lake now sees urban development of varying types and intensities, and natural landscapes are restricted to publicly owned areas, such as Emerald Bay State Park and the area around Fallen Leaf Lake in the Eldorado National Forest.

Large areas of the basin in public ownership (national forests and state parks) still offer natural landscapes of exceptionally high quality. These areas, however, are accessible only to those who know the area, who are able to hike for long miles, or who have advance reservations. In recent years, some areas of publicly held land have undergone visual deterioration as a result of intensive use. (Roadside campgrounds are especially susceptible to visual deterioration; large numbers of recreational vehicles and automobiles parked near the roadside are often visible where vegetation screens between campground and roadway have been removed.) The visual deterioration of publicly held lands is, however, insignificant compared to the visual degradation caused by private development.

Deterioration has occurred in the Lake Tahoe Basin in spite of numerous studies and recommendations made for direct design controls on development (TRPA, 1972; EDAW, 1975; and EDAW, 1974). Visual problems that have occurred within viewing distance of major roadways are shown below.

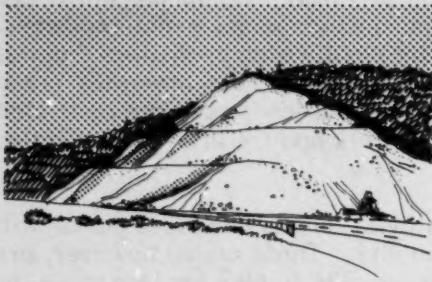
Problems



Single-family residential dwelling units that are obtrusively sited and project above the forest canopy.



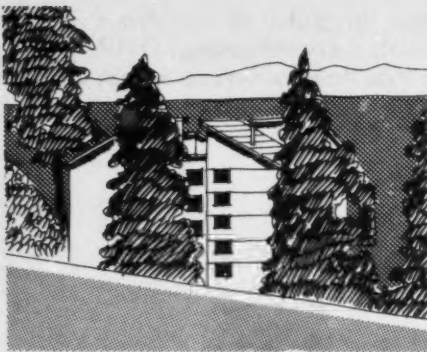
Single-family residential dwelling units that block views of the lake.



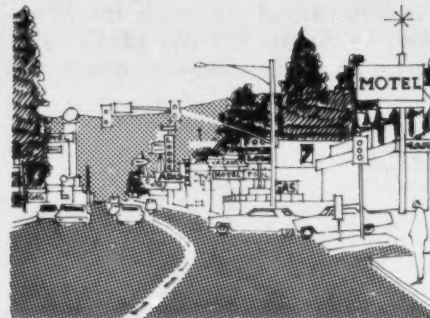
Grading or excavation for road or building pad construction that has resulted in loss of vegetation on cut banks and eroded slopes.



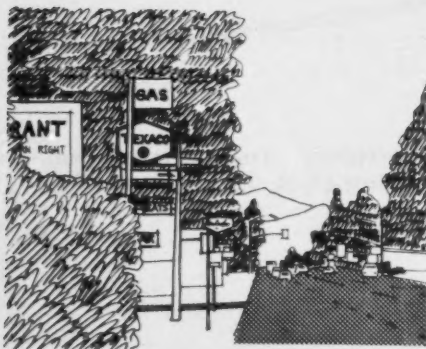
Building groups that alter the natural contours of the topography and remove significant amounts of vegetation.



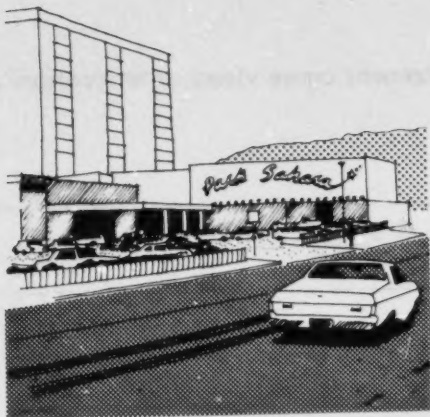
Structures of such height and bulk that they obstruct views of the lake or mountain backdrop.



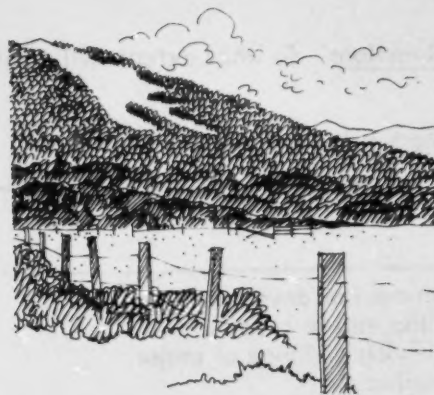
Strip commercial development that forms a solid visual barrier without view corridors to mountain backdrops or lake views.



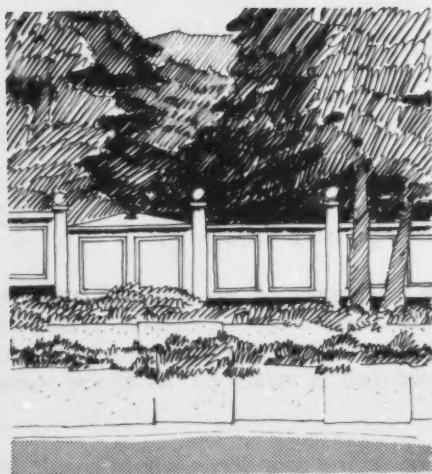
Commercial signs that are distracting, garish, or out of character with the natural environment.



Unlandscaped undivided roadways of four or more lanes with roadside parking.



Ski slopes that scar the mountain backdrop.



Fences or walls along the roadside that interrupt the natural character of the environment.



Structures whose exterior color and materials are out of character with natural surroundings.

IMPACT ASSESSMENT

Question: To what extent will additional development cause visual deterioration?

Measurements

	<u>Growth Scenarios</u>				
	1	2	3	4	5
Amount of development allocated to areas within viewing distance of major roadways					
STPUD					
Impact rating	Medium	High	High	Medium	High
DCSID					
Impact rating	Medium	Medium	High	Extreme	Extreme
Number of view corridors from major roadways likely to be blocked by development					
STPUD	7	13	10	7	13
Impact rating	Medium	High	High	Medium	High
DSCID	5	5	7	7	7
Impact rating	Medium	Medium	High	High	High
Reduction in visibility due to increased air pollution					
Impact rating	Low	Low	Low	Low	Low

Assessment of impacts on visual conditions assumes existing controls on types and location of development.

The first measurement reflects the assumption that development within viewing distance of major roadways would result in continuing visual problems.

To obtain the second measurement, an estimate was made of the number of view corridors to lake mountain backdrops that would be blocked by increased residential and commercial development along major roadways. In the Nevada Stateline area, continued highrise development (planned or approved) is assumed to block view corridors.

The third measurement assumes that violations of ozone standards would result in degradation of visibility. However, little work has been done to relate violations of the visibility standard with those of the ozone standard (see Table 29). The lack of an effective visibility monitoring system and enforceable standards is a major deficiency in the efforts to protect the basin's resources.

Description

Increased development would result in a worsening of visual problems. About 57 percent of major traffic zones in DCSID and all major traffic zones in STPUD to which development is allocated are close to major roadways. Because development occurs first in areas near roadways, a relatively large number of view corridors would be removed in Scenarios 1 and 4. Building in lots further from major roads and infilling of already developed areas would occur in Scenarios 2, 3, and 5.

Continued development within SEZs and low capability lands (classes 1, 2, and 3) would result in degradation of the aesthetic quality of Lake Tahoe waters through nutrient and sediment loading from surface runoff. (See discussion under "Water Resources and Water Quality.") Continued development would also cause reduced visibility as a result of increased air pollutants.

Further development would gradually transform the character of the Lake Tahoe Basin from a natural to an urban environment in areas most accessible to visitors and residents.

Critical Implications

At the high growth levels of Scenarios 4 and 5, continuing visual degradation and the gradual transformation of the basin into an urban setting would reduce the attractiveness of Lake Tahoe as a recreation destination. In Scenario 2, the type and location of much future development would be determined by the existence of subdivided parcels. Consequently, there would be less flexibility for mitigating visual problems.

MITIGATION MEASURES

1. Adopt ordinances to protect SEZs and low capability lands from further development. (See mitigation measure under "Water Resources and Water Quality.")
2. Adopt a transfer of development (density) rights system. (See mitigation measure under "Water Resources and Water Quality.")
3. Adopt design plan with implementing ordinances and provisions for design review.

Description. Would provide controls and guidelines for design, location, and types of development, and should include provisions to protect, maintain, and restore natural landscape on public and private lands.

Effectiveness. Would depend upon the quality of the plan, strength of implementing ordinance, and powers of the design review body. Could be extremely effective in improving visual conditions and protecting natural setting from degradation by development.

Responsibility. Local governments, TRPA, CTRPA, U.S. Forest Service.

Cost. Administrative, associated with plan development and implementation.

Timing. Some groundwork for this measure has already been done in urban design studies. Effectiveness of this measure will decrease significantly if it is not implemented within five years or before high levels of growth occur.

4. Establish a program for purchasing subdivided lots or acres which are zoned for development within urbanized areas and are in view corridors, SEZs, or high erosion hazard lands.

Description. Areas in environmental sensitive areas would be identified and an acquisition program targeted toward these areas would be developed. This program would provide means for preserving open space and view corridors and maintaining the natural character of the setting. It could be used in conjunction with a transfer of development rights process (see mitigation measure under "Water Resources and Water Quality"), or as matching funds for certain properties.

Effectiveness. Could be effective depending on the amount of public support the program receives.

Responsibility. TRPA, CTRPA, city of South Lake Tahoe, El Dorado and Douglas counties.

Cost. Administrative, plus costs for purchase of lands to be paid by donations and funds from public agencies.

Timing. Must be implemented before infilling in urban areas occurs.

5. Adopt nonattainment plan to improve air quality and enhance visibility (see "Air Quality").
6. Establish National Scenic Area (NSA) for the Lake Tahoe Basin.

Description. Would provide management, regulatory, and acquisition programs for maximum public use of the basin. Would help mitigate visual conditions resulting from development and preserve the natural visual character of the area.

Effectiveness. Could be most effective measure.

Responsibility. Adoption: U.S. Congress. Administration: U.S. Forest Service.

Cost. Undetermined, but would probably require massive purchases of privately held lands subdivided or zoned for development.

Timing. Long-range measure; would require congressional action.

E. INDIRECT EFFECTS (SECONDARY IMPACTS) : SOCIAL ENVIRONMENT IN LAKE TAHOE HYDROGRAPHIC BASIN

I. LAND USE

EXISTING CONDITIONS

Landownership

The single largest landowner in the basin is the federal government. Of the total basin land, the U.S. Forest Service administers 129,671 acres, and 63,730 area are privately owned. Table 30 shows public and private ownership by jurisdiction. Landownership patterns are shown in Figure 12.

Land Use

Land uses within the basin fall into five general categories: residential, commercial (including gaming), public services, recreation, and general forest (open space). Commercial development is concentrated along major roads (Highways 89, 50, and 28) encircling the lake. The most intensive commercial activity is clustered around the state line areas in Nevada and California at the northern and southern ends of the lake, where the casinos on the Nevada side act as magnets for hotels, motels, and related commercial uses. Most gambling-related development is on the California side of the basin. Most residential development is concentrated around the perimeter of the lake adjacent to the shoreline and in pockets of relatively flat land extending into the steeper areas of the basin. Permanent residences are concentrated in the south shore and north shore areas near the casinos and related employment centers.

Land use in the EIS study areas is summarized by watershed in Table 31. Land uses for the basin as a whole are summarized in Table 32 and shown on Figure 13.

Land Use Policy and Plans

Public Lands. The three national forests within the Lake Tahoe Basin, Eldorado, Tahoe and Toiyabe, are included within the Lake Tahoe Basin Management Unit (LTBMU). National forest lands are managed for outdoor recreation, range, timber, watershed, and fish and wildlife purposes.

In 1969 the U.S. Forest Service published its Multiple Use Management Plan for the National Forest Lands in the Lake Tahoe Basin. The purpose of this plan was to "intensify management of National Forest public lands to assure optimum use." Specifically, the plan coordinates resource uses and activities on U.S. Forest Service lands in the basin; it was the first attempt to unify management of the three national forests in the Lake Tahoe Basin.

TABLE 30
 LANDOWNERSHIP AND SHORELINE MILES: LAKE TAHOE BASIN¹

	<u>Acreage</u>	<u>Percent of Total</u>	<u>Miles of Shoreline</u>	<u>Percent of Total</u>
PUBLIC LAND AREA				
Federal: National Forests	129,671		10.7	15
Bureau of Reclamation	<u>64</u>			
Federal subtotal	129,735	63.2		
State: California	5,394		9.7	13
Nevada	<u>6,047</u>		<u>3.7</u>	<u>5</u>
State subtotal	11,441	5.6	13.4	18
Local: California	263			
Nevada	<u>80</u>			
Local subtotal	343	0.2	.5	1
TOTAL PUBLIC LAND AREA	<u>141,519</u>	<u>69</u>	<u>24.6</u>	<u>34</u>
PRIVATE LAND AREA				
California	41,760	20.3		
Nevada	<u>21,970</u>	<u>10.7</u>		
TOTAL PRIVATE LAND AREA	<u>63,730</u>	<u>31</u>	<u>47.0</u>	<u>66</u>
TOTAL LAND AREA	<u>205,249</u>	<u>100</u>	<u>71.6</u>	<u>100</u>

¹Landownership within the LTBMU is current as of June 1, 1978.

Source: U.S. Forest Service, Lake Tahoe Basin Management Unit,
 Land Management Plan - Part I, 1978.

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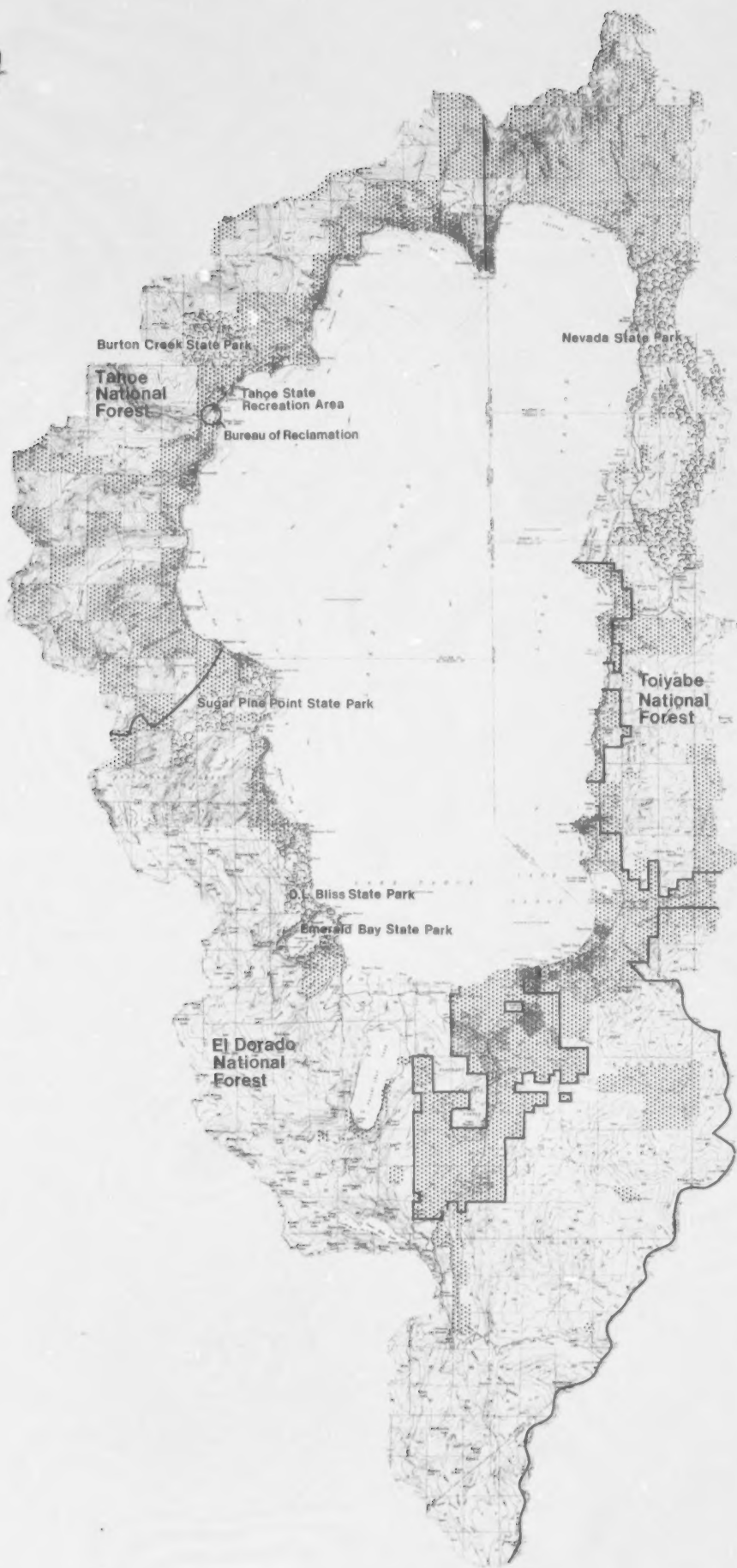




**Figure 12 LAND OWNERSHIP
LAKE TAHOE BASIN**

PRIVATE LANDS

STATE PARKS

NATIONAL FOREST BOUNDARY

NOTE: SOME PRIVATE LANDS FALL WITHIN NATIONAL
FOREST BOUNDARIES
PUBLIC LANDS WITHIN LOCAL JURISDICTIONS
ARE NOT SHOWN

Tahoe Region Environmental Evaluation Study

U.S. Environmental Protection Agency
Sedway/Cooke

B

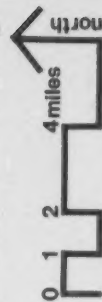


TABLE 31
LAND USE IN THE STUDY AREAS - 1976
Land Use Districts (area in acres)²

Watershed	No.	Name	LDR	MDR	HDR	RE	GC	TC	Rec	PS	Total Developed ¹	CR	GF	Total Un-Developed ¹	Total ¹
DCSID															
27	Deadman Point	--	--	--	--	--	--	--	--	--	--	--	654	654	654
28	Slaughter House	22	--	--	41	--	--	--	3	--	65	--	4,567	4,567	4,632
29	Glenbrook Creek	48	--	--	11	--	25	--	152	--	335	--	2,974	2,974	3,309
30	No. Logan House Cr.	--	--	--	80	--	--	--	--	--	80	--	973	973	1,053
31	Logan House Creek	42	--	--	7	--	--	--	--	--	49	--	1,494	1,494	1,542
32	Cave Rock	34	--	--	19	--	--	--	2	--	54	80	883	963	1,018
33	Lincoln Creek	69	--	5	--	--	--	--	16	--	90	53	1,458	1,510	1,600
34	Skyland	271	--	--	--	--	--	--	--	--	271	--	212	212	483
35	North Zephyr Creek	12	--	--	--	--	--	--	16	31	59	--	1,603	1,603	1,662
36&															
37	South Zephyr Creek	13	32	--	--	--	--	--	80	21	146	--	960	960	1,106
38	McFaul Creek	254	1	118	--	4	--	--	--	--	377	--	2,245	2,245	2,622
39	Burke Creek	294	35	466	48	70	75	--	277	37	1,301	58	1,958	2,016	3,317
40	Edgewood Creek	441	42	70	145	77	173	--	211	--	1,159	127	2,209	2,336	3,494
	Subtotal	1,500	110	659	450	151	273		741	89	3,986	318	22,190	22,507	23,175
STPUD															
41	Bijou Park	768	12	266	--	73	272		29	10	1,430	--	1,232	1,232	2,662
42	Bijou Creek	484	88	114	26	74	75		145	29	1,035	--	840	840	1,875
43	Trout Creek	1,536	266	130	10	113	41		--	96	2,193	--	23,356	23,356	25,549
44	Upper Truckee River	3,175	709	349	580	580	176		291	392	6,252	977	28,247	29,224	35,475
45	Camp Richardson	95	20	5	14	--	11		110	55	310	--	1,747	1,747	2,058
46	Taylor Creek	345	--	--	106	--	--		--	--	451	--	11,285	11,285	11,736
47	Tallac Creek	--	--	--	366	--	--		265	--	630	--	2,150	2,150	2,781
48	Cascade Creek	--	--	--	14	--	--		--	--	14	--	3,061	3,061	3,075
49	Eagle Creek	--	--	--	--	--	--		--	--	--	--	5,406	5,406	5,406
	Subtotal	6,403	1,095	864	1,116	840	575		840	582	12,315	977	77,324	78,301	90,617
	Total	7,903	1,205	1,523	1,566	991	848		1,581	671	16,301	1,295	99,514	100,808	113,792

¹ Columns may not equal total columns due to rounding.

Land Use Classifications: LDR - Low density residential; MDR - Medium density residential; HDR - High density residential; RE - Rural estates; GC - General commercial; TC - Tourist commercial; Rec - Recreation; PS - Public service; CR - Conservation reserve; GF - General forest

Source: TRPA, Regional Planning Agency, Lake Tahoe Basin Water Quality Management Plan, Vol. III, 1977.

TABLE 32
LAND USE IN THE LAKE TAHOE BASIN¹ - 1976

<u>Land Use</u>	<u>Acreage</u>	<u>Percent of Total</u>
RE (rural estate)	2,488	1.3
LDR (low-density residential)	13,308	6.7
MDR (medium-density residential)	1,626	0.8
HDR (high-density residential)	1,074	0.5
MTR (medium-tourist residential)	3	0.0
TC (tourist commercial)	1,024	0.5
GC (general commercial)	1,123	0.6
Rec (recreation)	2,207	1.1
PS (public services)	727	0.4
CR (conservation reserve)	---	0.0
GF (general forest)	174,538	88.1
TOTAL	198,118	100

¹ Land use designations are from the TRPA Regional Plan. Both public and privately owned acreages are included. Also included are subdivided but undeveloped acreages.

² Medium Tourist Residential is a relatively new district. Only one parcel is currently zoned MTR.

³ Although some land is currently zoned Conservation Reserve, its use is identical to land in the General Forest zone.

Source: TRPA 1977b.

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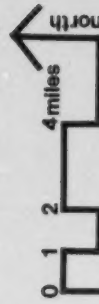
**Figure 13 EXISTING LAND USE
LAKE TAHOE BASIN**

-  SUBDIVISION (LESS THAN 50% DEVELOPED)
-  SUBDIVISION (MORE THAN 50% DEVELOPED)
-  COMMERCIAL
-  PUBLIC SERVICE
-  RECREATION

Tahoe Region Environmental Evaluation Study

U.S. Environmental Protection Agency
Sedway/Cooke

B



In 1973 the Forest Service distributed a preliminary general plan and an environmental statement for national forest lands in the Lake Tahoe Basin. Subsequently, a land use plan for the LTBMU and an environmental analysis report were developed. The plan discussed alternatives for general management and sought to coordinate the management of all national forest lands with plans for local agencies, such as TRPA, CTRPA, and the counties.

In 1978 the Forest Service issued a new policy plan (part 1 of the LTBMU Plan), which will supersede the 1969 management plan. A draft environmental impact statement (part 2) for this new plan was submitted to EPA in August 1979. Part 2 will propose alternatives for implementing the new policy plan, describe the "fair share" plan, and compare basin capacity on the basis of the land capability systems developed by the Forest Service and TRPA in 1971. Under the fair share alternative, the percentage of land coverage authorized by the land capability system will be allocated to major landowners (federal, state, and private interests). The landowners' "fair share" of basin services and resources, such as sewage treatment, air quality, and transportation, will be determined. The rationale for this alternative is that private lands within the basin are being developed faster than public lands, and public services are being committed to the private sector, thereby precluding the ultimate development of lands for public use. (Hoefler, pers. comm.; U.S. Forest Service, 1978b.)

The goal of the LTBMU Plan (U.S. Forest Service, 1978b) is ultimately to expand public ownership of the basin land to 85 percent. Sites under consideration for acquisition are evaluated according to criteria set forth in this plan. Before 1975 criteria for acquisition were set forth to provide the public with outdoor recreation areas; hence, land acquired before 1975 tended to be in remote areas rather than adjacent to already developed areas. In 1975 criteria for acquisitions were revised for the LTBMU Plan environmental assessment so that more emphasis is now placed on acquiring land in urban and shorezone areas and in areas where development could have an adverse impact on adjacent national forest lands or could be in conflict with Forest Service management (Hoefler, pers. comm., U.S. Forest Service, 1978b). If land is acquired as planned, federal ownership will increase to 79 percent by 1983.

The state of California has short-range plans for acquiring additional park land, but has no long-range goals for the area other than those that relate to management of existing park facilities.

The state of Nevada has no long-range plans for acquiring additional park land or for making changes in management policy for the Lake Tahoe-Nevada State Park.

Private Lands. TRPA is the only agency with basinwide jurisdiction over private lands. CTRPA, NTRPA, local counties, and cities have limited jurisdiction.

The need for a regional land use policy for the Lake Tahoe Basin as a single geographical entity was recognized in the 1960s. It had become clear that the regulation of private lands as then practiced by local jurisdictions was directed toward urbanizing an area valued for its exceptional natural assets. The California and Nevada state legislatures appointed a joint study committee, which recommended the formation of a strong regional agency. In 1967 the California legislature approved a bill to establish CTRPA, which was to become part of a bi-

state agency as soon as Nevada took similar action. In 1968 the state of Nevada established NTRPA, which was similar to CTRPA, except that it excluded gambling and Nevada public works projects from the control of the bi-state agency (Ames, 1972, pg. 12).

The Tahoe Regional Planning Compact was ratified by Congress in 1969, creating TRPA with "power to adopt and enforce a regional plan of resource conservation and orderly development" (PL 91-148). The TRPA Regional Plan for the Lake Tahoe Basin was adopted in December 1971. The plan included the land capability map and a system for land development based on physical land constraints such as slope, geology, soils, hydrology, and vegetation. The system established limits of impermeable surface areas for seven categories of land. The land capability map allowed for an increase of 30 percent over the coverage recommended by the original system. The compact recognized development rights for all existing lots.

The proposed update of the TRPA Regional Plan was completed in April 1978, and TRPA analyzed the impacts of a number of land-use alternatives to select a general plan alternative. The alternatives range from freezing existing development at present levels to substantial increases in development. Growth management techniques such as controlled rate of buildout are also being considered.

After having become part of TRPA in 1969, CTRPA became active again in 1973 as a result of the dissatisfaction of the California legislature with TRPA's voting procedures. CTRPA's zoning boundaries coincide with TRPA boundaries on the California side of the basin, but the CTRPA Regional Plan and Land Use Ordinance apply more restrictive land use coverage and densities and different permitted uses to TRPA's land use districts. In addition, the CTRPA plan provides that new residential development be considered only after 85 percent of vacant land parcels have been developed. The compact between the states specifies that the most restrictive land use regulation will govern in the basin; therefore, for the California side, the CTRPA Regional Plan and Land Use Ordinance apply, since they are more restrictive than either TRPA's ordinance or those of the local governments.

NTRPA was also reconstituted in 1973 by the Nevada legislature and has authority to review and approve proposed gaming activities on the Nevada side of the basin. NTRPA consists solely of the Nevada representatives of the governing body of TRPA.

The city of South Lake Tahoe reviews all land use applications before they are submitted to CTRPA. For most purposes, the land use ordinance for South Lake Tahoe is superseded by the more stringent CTRPA Land Use Ordinance. (Although recent actions by the city council indicate that they feel their authority is being unfairly preempted by CTRPA.) The city is preparing a growth management plan, and has formed a citizen's committee (the 20-20 Committee) to formulate goals for the plan. A policy study also has been conducted by the city (South Lake Tahoe, 1978a).

Neither Placer County nor El Dorado County formally adopted TRPA and CTRPA land use ordinances; however, CTRPA land use regulations apply on the California side of the basin and must be enforced by county governmental agencies. (The counties too feel that their authority is being unfairly preempted by CTRPA.) The city of South Lake Tahoe reviews applications and issues permits on all El Dorado County lands within the basin. El Dorado County also has its own grazing, tree-cutting, and encroachment ordinances, for which the public works department issues permits.

Douglas County, Washoe County, and Carson City have not formally adopted TRPA's land use ordinance; nevertheless, TRPA regulations apply to the Nevada side of the basin and must be enforced by county and Carson City agencies. The county and city agencies have permit authority over commercial gambling interests.

Conflicts Between Land Use and Environmental Quality

Public lands management in the basin focuses on providing the public with a satisfying outdoor recreational experience. Although there are no explicit quantitative standards now that define the level of environmental quality necessary to fulfill this objective, it is clear from the controversy surrounding conditions in the basin that this level of environmental quality, however undefined, is threatened.

Existing land use adversely affects water and visual quality. Water quality is affected by soil erosion and the sedimentation of surface waters caused by grading for buildings and roads. Visual quality is affected by the removal of natural vegetation, the alteration of natural landforms, and development.

Conflicts arise when attempts to protect environmental quality in the public interest infringe on private property rights. Land use regulations of TRPA and CTRPA have resulted in such conflicts, and legal action against CTRPA, TRPA, and local jurisdictions has been sought by individuals and corporations and as class actions for alleged inverse condemnation and denial of civil rights. Current actions involve potential liability in excess of \$36 million. (Owen and Rollston, 1978; Vostrez, pers. comm.) More recently, the TRPA Water Quality Management Plan (TRPA, 1977b), which recommended removal of development rights for subdivided lots within stream environment zones, has been controversial. The land use implications of these conflicts are described in "Water Resources and Water Quality."

The land capability system was used in the TRPA Regional Plan to designate lands that can support development with minimal environmental degradation (high quality lands) and lands that can support development only with a high degree of environmental degradation (low capability lands). Existing land use has been in conflict with this system. Although the TRPA and CTRPA land use ordinances specify maximum lot coverages based on the site's land use capability, provisions within the ordinances allow for overrides and variances that permit greater coverages. Overrides are particularly common on smaller parcels. Along with development in SEZs and high erosion hazard lands, lot coverage beyond that permitted by the land capability system is a primary source for accelerated erosion.

When the TRPA Regional Plan was adopted, there were a number of already subdivided but undeveloped acres included in the plan as approved parcels for residential or commercial development. On the California side of the basin, according to CTRPA estimates, in April 1975 there were still 1,691 unbuilt but subdivided lots in general forest zones, 15,692 lots in areas zoned for low density residential, and 3,000 to 4,000 lots in areas zoned for high density uses, for a total of 21,000 already subdivided lots. The number of subdivided lots on the Nevada side when the regional plan was adopted was estimated at 4,838. Because these lots were subdivided before the development of the land capability system, many of

them were in locations inconsistent with land capability as defined by the regional plan. In the STPUD service area, for instance, a total of 611 undeveloped residential acres are in high erosion hazard lands (about a quarter of all vacant residential land). The Douglas County building inspector estimates that almost all subdivided lots on the Nevada side were in high erosion hazard lands. Nearly half of all vacant residential land in DCSID are in high erosion hazard lands. Allowable densities on these lots were reduced by the regional plan from the densities allowed by local land use plans. However, the lots remain classified as developable--in conflict with land capability classifications.

In addition to already subdivided but undeveloped lots (included within "existing land use" by TRPA), an estimated 2,000 acres in high hazard lands have been zoned by TRPA for urban use (TRPA, 1977b). If these acres are assumed to be zoned as low density residential, they would yield a maximum of 8,000 housing units under the TRPA plan.

IMPACT ASSESSMENT

Question: How will land use be affected?

Measurements

	1978	1	2	Growth Scenarios		5
				3	4	
Percent of vacant land in land use districts developed						
STPUD						
Residential	57	68	100	83	68	100
General commercial	67	80	103	91	75	105
Tourist commercial	64	72	82	88	72	96
Impact rating		Low	High	Medium	Low	High
DCSID						
Residential	65	88	88	93	100	100
General commercial	21	36	30	56	100	100
Tourist-commercial	37	54	54	86	100	100
Impact rating		Medium	Medium	Medium	Extreme	Extreme

Note: Percentages of vacant general commercial land developed may exceed 100 percent because land is assumed to be rezoned from other USCS to general commercial in order to accommodate projected demand for general commercial activities.

Measurement of vacant land area in each land use district assumes 20 tourist commercial hotel/motel rooms per acre for STPUD and 40 rooms per acre for DCSID. The remaining residential land supply in California is assumed to be limited to buildout of existing subdivided lots at four lots per acre. DCSID 1978 residential acreages were approximated by assuming two dwelling units per acre for single-family homes and eight dwelling units per acre for multi-family homes. Existing general commercial uses in Douglas County are assumed to average two stories, and projected general commercial uses, three stories. In California new general commercial uses are assumed to average two stories. Acreages estimated are approximate and are derived from average densities rather than field-checked land use inventories. They are intended to provide comparative estimates only.

The measurement assumes that the smaller the percentage of land developed, the greater the flexibility in planning and coordinating location and timing of development to avoid conflicts between land use, environmental quality, and economic conditions. For example, under high growth levels (Scenario 5), almost no land would remain for development. Consequently, the land use pattern would be fixed. Then, a new transportation system would have to be planned for the fixed pattern, at perhaps higher costs than if the land uses and transportation system were planned together.

Levels of growth translated into land use changes are responsible for many of the environmental impacts assessed in this report. For detailed descriptions of land use impacts, refer to specific sections.

Description

For the STPUD area, Scenarios 1 and 4 provide the least amount of change in land use and the highest degree of land use flexibility. Scenarios 2 and 5 provide the greatest amount of change in land use and the lowest degree of flexibility. Because of the CTRPA 85 percent buildout rule in California, residential land use under Scenarios 2 and 5 would exist as large areas of relatively low density development. Development under these scenarios would preclude use of development control techniques such as clustered housing units and transfer of density rights that would mitigate various environmental and economic problems (such as visual disruption, encroachment on SEZs, and provision of costly services and utilities).

Remaining land area available for general commercial use in STPUD amounts to approximately 400 acres. An additional 200 acres would be used for tourist commercial at buildout. Most commercial land area is concentrated along Highway 50 and south of the Y, and increases in commercial development could result from infilling in these areas.

For DCSID, Scenarios 1 and 2 would provide the least amount of change in land use and the highest degree of flexibility. Scenarios 4 and 5 would provide the greatest amount of change in land use and the lowest degree of flexibility. Residential buildout would result in more compact development than would occur on the California side due to variations in housing densities; however, the largest amount of land at residential buildout would be in low density scattered development (64 percent of available residential acres), which, again, would preclude development control options.

Commercially zoned land in DCSID is also limited. Conversion of some general commercially zoned land for tourist commercial uses would be necessary under buildout, because buildout of tourist commercial land uses would exceed tourist commercially zoned land. Under Scenarios 4 and 5, residentially zoned land would have to be rezoned to tourist commercially zoned land. In addition, on land zoned for tourist commercial, coverage would have to be reduced and heights increased to accommodate projected growth. Most commercially zoned land is concentrated along Highway 50 in the Stateline area and on the Kingsbury Grade road.

Critical Implications

Land uses in the south shore area have already caused significant environmental and economic problems. Conflicts between land use and water quality, air quality and traffic conditions have been documented, as have economic difficulties in providing needed services for existing land uses. Without extensive mitigation, further development is likely to exacerbate existing problems.

MITIGATION MEASURES

Mitigation measures for impacts resulting from land use changes are discussed under appropriate factors. Refer to specific sections.

2. HOUSING

EXISTING CONDITIONS

Housing Stock

Of the stock of housing (single-family and multiple units) in the south shore area, about 60 percent is used by residents (CTRPA, TRPA/TRTS), and about 40 percent is used seasonally by nonresidents (second homes). In El Dorado County, a larger share of housing is used by nonresidents than in Douglas County. The overall trend seems to be toward less seasonal use, particularly in El Dorado County, although this pattern has started to change as housing prices have escalated.

About 85 percent of the multiple units in the south shore area are occupied by residents, many of whom are employed in the area (TRPA, 1978a). The stock of single-family units serves both resident and nonresident households. Housing types and distribution in STPUD and DCSID are shown in Table 33. In addition to single- and multiple-family units, a small amount of housing (488 units for residents in 1974) is provided by hotel and motel rooms rented on a long-term basis and by rooms in group quarters.

Recent building permits indicate that Douglas County's share of south shore residential construction is growing. Because of land use policies and market pressures, new residential construction is of single-family homes in El Dorado and a mix of types of units in Douglas County.

TABLE 33

HOUSING STOCK: STPUD AND DCSID, LAKE TAHOE BASIN
SUMMER 1978

Housing Type	South Lake Tahoe ¹	Unincorp. El Dorado County ¹ in STPUD	Total El Dorado County ¹ in STPUD	Douglas County ² in DCSID	Total STPUD ³ & DCSID
Single family	6,898	4,195	11,093	1,606	12,699
Multiple family	4,657	59	4,716	929	5,645
Mobile home	774	--	774	450 ⁴	1,224
TOTAL UNITS	12,329	4,254	16,583	2,985	19,568
Percent of total stock	64	22	85	15	100
Percent of total represented by:					
Single-family homes	56	99	67	54	65
Multiple units	38	1	28	31	29
Mobile homes	6	--	5	15	6

¹Information from CTRPA. El Dorado County housing units outside of STPUD are excluded from figures shown here.

²Information from TRPA.

³Excludes units approved and under construction but not yet completed in summer 1978.

⁴Estimate based on 1974 TRTS information.

Source: Recht Hausrath & Associates based on sources identified above.

Because the Lake Tahoe Basin is a recreation/resort area, vacancy rates vary throughout the year. Rates are lowest during the summer months when employment and visitor levels are at their highest. In general, vacancy rates of the resident housing stock are low due to the strong demand for housing relative to the supply, but actual rates are difficult to estimate because of shifts from resident to nonresident use and high turnover of this stock. Residential units in the lower and middle price ranges are most in demand, and vacancies are very low in these categories. Some nonresident, seasonal housing stock is always available for temporary, nonresident occupancy.

Housing Quality

The quality of the housing stock is upgraded over time in market situations where demand for housing exceeds the supply and where housing consumers have the resources to improve their property or to pay for units that have already been upgraded.

Undermaintenance and longer term deterioration occur when owners do not have the ability or, because of a competitive housing market, the incentive to make needed repairs. Undermaintenance and housing deterioration usually occur in neighborhoods with the lowest prices and rents, oldest stock, and higher densities.

In 1971 there were nearly 747 single-family units in the basin that could be classified as deteriorating and 185 units that could be classified as dilapidated (TRPA, 1978a). About 80 percent of these units, many of them built as summer cabins without insulation, plumbing, or heat, were in the south shore area in older neighborhoods. (More current information on the condition of housing in the south shore is not available.)

Today, conflicting trends in the maintenance and improvement of the housing stock are seen. On the one hand, increasing prices and shortages of units make it profitable for individuals to buy and upgrade older units for eventual sale at a price well above their purchase price. On the other hand, owners are able to charge higher rents without making improvements or repairs (given significant numbers of renters with few options who are willing to double up to find housing) and often allow overcrowding. Although the extent of either trend is uncertain, the trend is probably toward upgrading.

Housing Prices

Housing prices and rents have increased rapidly throughout the basin. Between 1971 and 1976, prices of improved property increased 12 to 15 percent per year. In 1977 and 1978, the rate of increase escalated; for homes in the south shore area, prices have increased 45 to 50 percent.

In general, units priced from \$40,000 to \$50,000 are at the low end of the scale, as evidenced by a recent sale of an older, summer cabin with no insulation or heating in the south shore area for \$42,500. Rates of appreciation have been greatest for units in the lower and medium price ranges (under \$125,000) and somewhat less for units in the highest price range.

A number of factors contribute to rising housing prices in the basin. The number of households seeking housing exceeds the supply of available units. Faced with increasing competition for housing, enough households are able to pay higher prices to increase prices for the entire market.

Increased employment in the south shore area and larger numbers of retired and second-home buyers have increased demand for housing. Trends toward fewer children per family and the employment of both spouses, the greater number of households nearing retirement age, and higher incomes have increased the number of retired and second-home buyers.

Construction of new units has been affected by actual and expected changes in public land use policy, moratoriums on new development, and increased construction costs. Thus, additions to the stock of different types and prices of housing have not kept pace with demand.

The ability of households to secure affordable housing within the basin depends on their ability to pay for it. Employee households in the service-based economy of the basin increasingly receive wages that place them at the lower end of those competing for housing. Their incomes have not kept pace with housing prices. As a result, many have had to pay higher proportions of their income for housing, and others have been forced to move outside the basin (usually to Carson Valley and Carson City). In general, it has been the family households that have moved outside the basin; younger, single households often pool their incomes in order to secure living quarters (a situation that often leads to overcrowding).

The two other major groups of housing consumers, second-homeowners and retired households, potentially include a mixture of types of households with varying preferences and abilities to pay for housing. However, the actual mixture is reduced when choices are limited and competition is strong. Then only those who can and will pay higher prices will secure basin housing; those unable to afford the high prices are forced to look elsewhere. With a broad range of types of new units and with moderate price increases, the mix of households is likely to be more heterogeneous.

TRPA (1978a) has estimated that in 1974 nearly 20 percent and by 1976 an even larger percentage of resident families owning homes in the south shore area were paying more than two times their annual income for housing (the standard used by TRPA for measuring over-payment). TRPA has also estimated that 68 percent of households in the south shore rental market are overpaying (based on a standard of overpayment of more than 25 percent of monthly income). (Ability to pay for housing may be somewhat greater than indicated by reported income because of income from tips. However, although nonreported income increases ability to pay monthly rents, it may not substantially increase ability to purchase housing because of the problems of securing financing based on unreported and somewhat uncertain income.)

IMPACT ASSESSMENT

Question: To what extent will housing consumers be able to secure affordable housing in the south shore area, and how will different groups of consumers be affected?

Measurement

	1	2	<u>Alternatives</u> 3	4	5
Rate of housing price increase	High	Moderate, similar to inflation	Moderate, somewhat higher than inflation	High	Moderate, somewhat higher than inflation
Choices available (prices and mix of units)	Very little choice range	Wide range of price choices; limited mix of new units types	Moderate range	Limited range of price choices; greater mix of new unit types	Moderate range
Proportion of new employee households likely to find basin housing	About half	About three-fourths	About two-thirds	About one-third	About half
Types of second home and retired households able to compete for basin housing	Only those who can afford higher priced units	Many household types and incomes	Some household types and incomes	Only those who can afford higher priced units	Some household type, and incomes

Employee households are assumed to be able to spend two to three times their annual income for housing.

Higher priced units are assumed to cost \$125,000 or more, and moderate priced units to cost \$75,000 to \$125,000 (all in 1978 dollars). Price trends are averages for the total housing stock (existing and new units).

Description

Because of the growth of south shore employment and the increasing numbers of retired households and second-home buyers, demand for housing in the south shore basin will be strong under all scenarios. Housing prices are likely to increase by at least the rate of inflation under all scenarios. Average prices of available units will be highest for scenarios where housing supply lags further behind.

Critical Implications

In general, the higher the price of housing, the more the ability to pay for housing is a determinant of who can live in the Lake Tahoe Basin.

To the extent that it will be difficult for employee households to find affordable housing:

- demand for housing will "spillover" into nearby areas, particularly in the Carson Valley areas of Douglas County; this will increase distances between residences and place of employment.
- some households will pay more than they can afford for housing and will have less income to spend for other goods and services, including housing maintenance and improvements.
- some households will have to accept what is available even if their needs and preferences are not fully met, and the incidence of overcrowding may increase.

To the extent that housing opportunities are limited to those second-home buyers and retired households with the willingness and ability to compete for available units, other households in these consumer groups will be unable to secure housing in the south shore area.

Question: How will the quality of the housing stock in the south shore area be affected?

Measurements

	1	2	Growth Scenarios		5
			3	4	
If spillover accom- modated outside Lake Tahoe Basin					
STPUD	Strong pressure to upgrade	Mainte- nance likely	Mainte- nance in most areas, some under- mainte- nance in older areas near Stateline	Strong pressure to upgrade	Mainte- nance in most areas; more under- mainte- nance in older areas near Stateline
Impact rating	Low	Low	Medium	Low	Medium
DCSID	Strong pressure to upgrade	Strong pressure to upgrade	Maintenance in most areas; under- maintenance in higher density areas near Stateline and Kingsbury Grade.		
Impact rating	Low	Low	Medium	Medium	Medium
If spillover not accom- modated outside Lake Tahoe Basin					
STPUD & DCSID Impact rating	Low	Low	Medium	High	High

Higher housing prices will result in buyers who demand quality, and there will be pressures for quality construction and maintenance. A tight housing market, affordability problems, and overcrowding lower concern for quality and increase deterioration in older, higher density neighborhoods.

Description

Undermaintenance and deterioration arise primarily as functions of the number of employee households who cannot secure affordable housing but who must live somewhere within commuting distance. Assuming that households included in the

spillover are housed outside the basin, there will be pressures for undermaintenance and longer term quality deterioration in some south shore neighborhoods—although probably not to a substantially greater extent than at present. Much more extensive undermaintenance problems will result if spillover households cannot find housing outside the basin.

Housing quality problems could be most extensive under Scenarios 4 and 5. Under all scenarios, the availability of housing in Carson Valley and other nearby areas will have a significant influence on housing quality in the south shore.

Critical Implications

Changes in housing quality affect expectations and investment levels and thereby influence subsequent changes in housing and neighborhood quality. Improvements in quality lead to further investment and improvements. Deterioration can result in less investment in nearby properties and can affect the feasibility of new development by keeping rents and prices below those needed to amortize the costs of new construction. In a tight market, deterioration trends could limit the expansion of housing stock in areas where housing is most needed.

Although prices and rents are likely to increase as quality increases, they do not necessarily fall as quality falls, and where deterioration has set in, some consumers will be overpaying for the quality of housing they receive.

Question: To what extent will presently subdivided lots be developed for housing, and how will landowners and investors be affected?

Measurement

	1	2	Growth Scenarios		5
			3	4	
Percent of presently subdivided, residential lots likely to be developed for housing					
STPUD	20	100	60	20	100
Impact rating	High	Low	Medium	High	Low
DCSID	100	100	100	100	100
Impact rating	Low	Low	Low	Low	Low
Percent of housing units presently allowed under TRPA residential zoning likely to be developed on unsubdivided land					
DCSID	10	10	68	100	100
Impact rating	High	High	Medium	Low	Low

Measurements assume that subdivided residential lots would be developed before unsubdivided land is developed. For STPUD the high growth scenarios assume buildout of vacant, subdivided lots (10,000 lots for 10,000 new units) and no further residential development. For DCSID the high growth scenarios assume buildout at maximum densities allowed by zoning of all vacant, subdivided lots (for 950 units) and of all vacant, unsubdivided, residentially zoned land (for 7,280 units).

Percentages assume that subdivided lots and zoned land are developable from physical/engineering, marketability, and regulatory perspectives.

Description

Under Scenarios 1, 3, and 4, some subdivided lots in STPUD would not be developed. Under Scenarios 1, 2, and 3 in DCSID, some unsubdivided, vacant land presently zoned for residential uses would not be developed. In DCSID, all subdivided lots would be developed under all scenarios.

Given present policies, lands developed under the medium and low growth scenarios would be those where necessary permits and approvals could be obtained. It is not possible to identify which those would be, especially since permits are granted in STPUD on a random basis.

Critical Implications

Owners (and/or investors) of vacant land who are able to build have the potential of earning income from the use of their land for housing. Those who are not able to build would lose their investment and potential to earn income.

For those scenarios where development would be allowed on only some residential lots or land, land values could be higher than they might have been because housing prices are higher as a result of the addition of fewer units. Thus, landowners and investors who can build might benefit from medium or lower growth scenarios. Owners of existing housing might also benefit from increased values of existing property.

MITIGATION MEASURES

1. Compensate land owners who experience losses because of lower growth levels. (See mitigation measure under "Water Resources and Water Quality.")
2. Redistribute development to reduce loss among landowners through transfer of development rights. (See mitigation measures for "Water Resources and Water Quality.")

Housing Quality and Affordability

3. Encourage development of moderately priced housing in nearby areas outside the Lake Tahoe Basin.

Description. Although the scenarios identify spillover as employee households that will have difficulty securing affordable housing in the Lake Tahoe Basin, no specific measures have been set up to insure that these households would in fact find housing outside the basin. Measures to encourage such development include zoning to allow for medium to higher density tract housing, for mobile homes, and for duplexes and attached townhouses. An assessment should be made of development standards, project review procedures, and other development requirements to insure that they do not discourage development of moderately priced units. Significant numbers of such units must be added or market pressures would still bid up prices. Attention should also be given to providing infrastructure and major public service facilities for development in undeveloped areas. Given the interdependence of housing markets, some form of public revenue sharing between the Lake Tahoe Basin and the Carson Valley may be appropriate.)

Effectiveness. This measure is probably the only way of significantly affecting housing affordability and would relieve pressures for undermaintenance and quality deterioration.

The effectiveness of this measure could be affected by spillover households from Carson City and Reno in search of housing in Carson Valley. These households would increase competition for available units and could affect the political feasibility of expanding the housing stock in Carson Valley. Unlike the spillover from the Lake Tahoe Basin, which results from economic activity that provides a tax base to the entire county, spillover from these other areas may not be seen as a need to be met by county policy.

Responsibility. Douglas County Planning Department in conjunction with other regional and local governments and public service agencies.

Timing. Coordinate with revision of Douglas County General Plan.

4. Encourage housing rehabilitation loans and grants, code enforcement, and presale inspection programs.

Description. These programs would be set up to detect housing quality problems and to assist in making needed repairs. Loan and grants programs could be set up to assist owners who cannot afford to make repairs or who wish to upgrade properties in designated areas or with certain kinds of problems. Special attention could be given to older housing and to units built as summer cabins that are now used as year-round housing. Code enforcement and inspection programs could help detect problems, but they should not be implemented in such a way as to discourage owners from participating in rehabilitation programs.

Effectiveness. To the extent that loan and grant programs are made available and used, they could be effective in improving housing quality. The effectiveness of code enforcement would depend largely on the incentives and assistance available to make repairs.

As housing prices and rents often increase to recover costs of improvements and to reflect upgraded quality, these measures will be most effective in combination with those described under measure 3, above. Further, it may be difficult to secure the funds for loan or grant programs. Probably the best possibility for such funds would be from private financial institutions, backed by local or state governments.

Responsibility. Local housing authorities or agencies and/or building departments.

Cost. Cannot be estimated without inspection of properties and would depend upon the extent of such programs and the abilities of owners to make repairs without financial assistance.

Timing. A south shore housing inventory is needed before the level effort and funding can be determined.

5. Improve neighborhood facilities, services, and amenities to encourage private-sector investment.

Description. Publicly funded or sponsored improvements to neighborhood facilities, services, and amenities could be made in an effort to stimulate private investment to maintain and improve housing quality. Included could be recreation facilities, trees, parks, street improvements, street lighting, sidewalk improvements, curbs and gutters, and improved service delivery (police patrol, recreational programs, etc.). Priority should be given to pivotal neighborhoods where undermaintenance and quality problems are just beginning and to older neighborhoods where private rehabilitation may be just beginning.

Effectiveness. While these measures could be effective, they could increase housing prices and rents. The measures would be most effective in combination with measures 3 and 4, above.

Responsibility. Local housing or planning agencies; public works departments and public service agencies.

Cost. Can only be estimated after neighborhoods are chosen, needs are assessed, and improvements are suggested.

Timing. A south shore housing inventory is needed first to identify pivotal neighborhoods and appropriate facilities, services, and amenities.

6. Increase allowable densities or redistribute densities through a transfer of development rights system that encourages greater mix of types of new units.

Description. Changes in allowable densities and cluster development would allow a higher percentage of multiple-family units (condominiums and apartments) or a higher percentage of single-family houses on smaller lots. This could provide for a greater mix of types and prices of housing. See discussion of transfer of development rights under "Water Resources and Water Quality."

Effectiveness. The effectiveness of this measure is limited by housing supply and demand relationships. Thus, under some scenarios, higher priced multiple units and single-family detached housing would be built even if densities were increased because the high market prices of these units would make them the most profitable to build.

This measure could potentially be most effective under Scenario 2 and to a lesser extent under Scenarios 3 and 5.

Responsibility. TRPA, CTRPA, and county and city agencies.

Timing. Coordinate with TRPA and CTRPA regional plan updates.

7. Institute incentives for new development to include a share of moderately priced housing.

Description. Policies could require that a percentage of new units be of a certain type and initial price or be available for rent rather than sale. Rather than fix requirements, policies could reward those who meet certain conditions (with density bonuses, etc., see measures 6 and 7 above).

Effectiveness. This measure would increase the mix of types and prices of new units; it would not increase the total supply of housing. As a result, prices and rents of units initially available at moderate levels would probably be bid up by market competition. (This is more likely to occur where moderately priced units are part of larger developments with more expensive housing.) This measure can only be effective where large acreages or a large number of subdivided lots are included in one development project or plan. Thus, it would be more effective for areas in DCSID than in STPUD. Overall, it would have the best chance of being effective, though only to a limited extent, under Scenarios 3, 4, and 5.

Responsibility. TRPA, CTRPA, and appropriate city and county agencies.

Timing. Coordinate with TRPA and CTRPA regional plan updates.

8. Institute incentives for casinos to expand housing stock when expanding gaming activity.

Description. Policies could require that new units of a certain type and price range be provided as a condition of gaming expansion or as a trade-off for density bonuses, etc.

Effectiveness. Limited to Scenarios 3, 4, and 5 and to situations with large-scale new construction (such as a new casino). Overall impact on housing market would depend on number of units added.

Responsibility. TRPA.

Timing. Coordinate with TRPA plan updates.

9. Coordinate regionwide land use policies; coordinate local, regional, state, and federal land use planning efforts.

Description. Land use policies for the Nevada and California portions of the Lake Tahoe Basin and Carson Valley should be coordinated. These areas are part of the same housing market, and decisions that result in increased housing demand (casino expansion, for example) or affect housing supply can influence affordability in the three areas. Once facility alternatives for both STPUD and DCSID are selected, attention should be given to the land use policies that will be used to reduce adverse impacts.

Effectiveness. Could be effective in regulating rate of development and coordinating growth with housing availability.

Responsibility. Regional, local, state, and federal agencies, with those at the regional level taking the lead.

3. TRANSPORTATION

EXISTING CONDITIONS

Transportation Facilities

Although limited bus, rail, and air services are available, travel to and within the basin is almost exclusively by automobile. Access to the basin can be made on one of the three major highways shown in Figure 14: Interstate 80 in the north, U.S. 50 in the south, and U.S. 395 in the east. U.S. 50 passes through the Tahoe basin and along part of the shoreline, providing direct access to the south end and east sides of the lake. I-80 and U.S. 395 do not enter the basin, but traffic from these two highways has access to the lake by way of connecting state highways. Of the seven highway entrances into the basin, six are two-lane roads, and one, U.S. 50 through Spooner Summit, is an undivided, four-lane highway with full shoulders, high-speed alignment, and moderate grades.

U.S. 50, south of South Lake Tahoe, and Highway 89, west of Tahoe City, are the two principal access routes into the basin for California drivers. Average daily traffic volume on these routes during the peak summer month in 1977 exceeded capacity. Congestion occurs on these routes during the winter season because of heavy traffic volumes and ice and snow removal.

Limited public transportation into the basin is available. The Greyhound bus line serves South Lake Tahoe and Truckee on a regular though limited schedule, and charter bus service is available through Stateline casinos, Greyhound, and several other bus companies. Amtrak operates one passenger train daily in both directions through Truckee.

There are airports at South Lake Tahoe (Tahoe Valley Airport), Truckee (Tahoe-Truckee Airport, which serves only general aviation), Reno (Reno International Airport), and Carson City. Commercial airlines provide limited but expanding service to the Tahoe Valley Airport. An "airporter" bus service runs between the Reno airport, Carson City, and the south shore casinos.

Traffic circulation within the Lake Tahoe Basin depends on U.S. 50 and the state highway segments (shown in Figure 14) that together form a continuous highway ring around the lake. The driving distance around the ring is about 72 miles. Highways in the basin are two-lane roads, except for a few four-lane sections.

About one-third of the 72-mile ring around the lake has serious problems of traffic congestion, nearly all of it on the California side, particularly along a segment of U.S. 50 from the "Y" east of Stateline. The west shore south of the Tahoe City area and the east shore are relatively free from congestion during summer months; California 89 along the west side of the lake is sometimes closed by snow and other weather conditions during the winter.

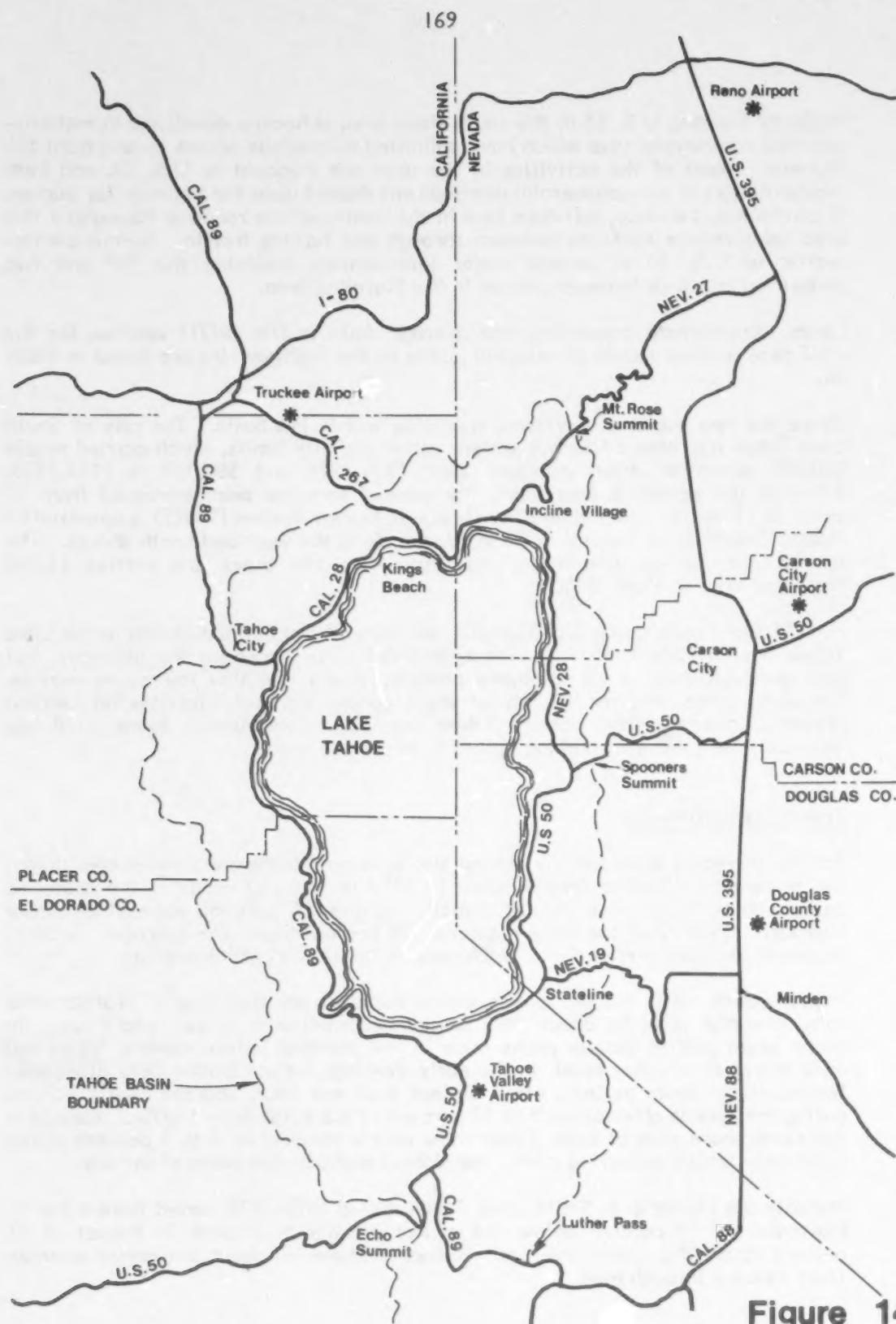


Figure 14
TRANSPORTATION FACILITIES
LAKE TAHOE BASIN

Property fronting U.S. 50 in the south shore area is heavily developed in highway-oriented commercial uses which have unlimited automobile access to and from the highway. Most of the activities in the area are adjacent to U.S. 50, and both residential areas and commercial development depend upon the highway for access. A continuous, two-way, left-turn lane in the center of the roadway throughout this area helps reduce conflicts between through and turning traffic. Signals control traffic on U.S. 50 at several major intersections including the "Y" and two pedestrian crossings between casinos in the Stateline area.

Lanes, approximate capacities, and average daily traffic (ADT) volumes for the 1977 peak summer month at selected points on the highway ring are listed in Table 34.

There are two public bus systems operating within the basin. The city of South Lake Tahoe operates a five-bus system within the city limits, which carried nearly 400,000 passenger trips in fiscal year 1974-1975 and 580,000 in 1977-1978. Although the system is subsidized, the general fare has been increased from 35 cents to 75 cents. The Tahoe Area Regional Transit System (TART) is operated by Placer County from Tahoma to Kings Beach along the west and north shores. The system operates on 60-minute headways using two buses and carried 11,000 passenger trips in 1974-1975.

In 1977 there were about 22,000 public and commercial parking spaces in the Lake Tahoe Basin (CTRPA, 1977e). These included curb spaces on the highways, but excluded residential areas and motel parking. About 11,000 of the spaces were on the south shore, and nearly half of these spaces were at Stateline and served Harvey's, Harrah's, and Sahara Tahoe casinos. Construction since 1978 has increased the number of parking spaces in the casino area.

Travel Characteristics

Traffic increases substantially during the summer months and on weekends during the ski season. Traffic counts taken in 1977 on U.S. 50 north of the Stateline casinos showed July and August traffic volumes 36 percent above the annual average. January had the lowest volume, 24 percent below the average. Volumes in March and April were only 15 and 4 percent below the annual average.

Hourly variations in traffic volume within the basin are significant. Traffic tends to be at a high level for about eight to nine hours between 10 a.m. and 8 p.m. (In urban areas traffic usually peaks once in the morning before working hours and once more, at a higher level, in the early evening. Urban traffic generally peaks for relatively short periods, often of less than one hour, and the hourly volume during the peak is often about 9 to 10 percent of the total daily traffic.) Counts in the south shore area at Lake Tahoe show hourly volumes of 6 to 7 percent of the total daily traffic occurring during the highest eight or nine hours of the day.

Monthly bus ridership in South Lake Tahoe during 1977-1978 varied from a low in November of 19 percent below the annual average to a peak in August of 21 percent above the annual average. Ridership stayed at about the annual average from January through May.

TABLE 34
LANES, CAPACITIES AND 1977 ADT
ON HIGHWAYS IN THE LAKE TAHOE BASIN
(Peak Summer Month)

<u>Highway Segment</u>	<u>Number of Lanes</u>	<u>Practical Capacity</u>	<u>1977 ADT</u>
U.S. 50 South Lake Tahoe, East of "Y"	4	35,000	43,500
U.S. 50 South Lake Tahoe, east of Truckee R. Br.	4	35,000	54,000
U.S. 50 South Lake Tahoe, east of Ski Run Ave.	4	35,000	49,500
U.S. 50 South Lake Tahoe, at State Line	4	35,000	39,000
U.S. 50 ½ mile northeast of State Line	4	35,000	39,400
U.S. 50 South of Jct. Nev. 28	4	35,000	11,800
Nev. 28 North of Jct. U.S. 50	2	12,000	6,000
Nev. 28 East of State Line	2	12,000	15,000
Cal. 28 East of Cal. 267	4	---	22,000
Cal. 28 Lake Forest	2	12,000	12,000
Cal. 28 Tahoe City	2	12,000	22,000
Cal. 89 Tahoe City	2	12,000	18,500
Cal. 89 2 miles south of Cal. 28	2	12,000	11,300
Cal. 89 North of Emerald Bay	2	12,000	4,600
Cal. 89 South Lake Tahoe, north of "Y"	4	---	22,000

IMPACT ASSESSMENT

Question: How will growth affect traffic conditions and congestion?

Measurements

	1978	1	2	<u>Growth Scenarios</u>		
				3	4	5
Traffic volume on U.S. 50 at Upper Truckee River Bridge	50,000	51,500	60,000	65,700	62,900	71,500
Traffic volume on U.S. 50 west of Park Avenue	46,000	54,000	63,000	69,000	66,000	75,000
Traffic volume at State-line (on U.S. 50 and Loop Road)	44,000	57,100	66,700	73,000	69,800	79,300
Impact rating		High	Extreme	Extreme	Extreme	Extreme

Year-2000 traffic volumes were estimated by factoring the results of a 1995 traffic assignment prepared by Caltrans using population and employment assumptions from the growth scenarios. Traffic volumes assume the existing road system with no other additions except the completion of the Loop Road around the casinos. The measurements refer to 24-hour average summer weekday traffic volumes.

Description

Development will bring more people to the basin, which will further increase the volume of traffic. Traffic that is generated by residential development can be expected to increase in almost direct proportion to the population increase.

Traffic generated by the casinos is only partly determined by floor area in the casino development. The attractions offered, intensity of advertising outside the basin, attitudes and expendable income within the gambling market, and available facilities in the casino area, such as parking and overnight accommodations, will also affect the number of casino visitors.

Traffic congestion is severe on weekends and holidays and can last on a particular day for eight hours or more. Congestion takes the form of long traffic queues and stop-and-go driving on U.S. 50 in South Lake Tahoe and the casino area. Periods of significant congestion probably occur on 25 to 30 percent of the days in the year.

Congestion interferes with the operation of emergency vehicles and buses, reduces access to business and residential areas, diverts through traffic to local streets,

contributes to air pollution, and generally interferes with the appreciation of the environment by visitors and residents.

Critical Implications

Traffic conditions in the STPUD and DCSID areas are now so congested that level of service is not a satisfactory measure of adequacy. An action that would cause even a small increase in existing traffic should be considered to have undesirable traffic impacts. Actions that would cause a significant increase in traffic should be considered to have extreme traffic impacts.

Measures to increase the speed of traffic such as widening or constructing roads might initially help reduce negative impacts on travel time and air quality, but would eventually lead to higher volumes, which, in turn, would reduce speed to former levels.

Increasing traffic capacity would also encourage continued reliance on automobiles. Investments would continue to be made in new development in locations determined by automobile accessibility and supporting automobile-oriented facilities such as parking. The location and arrangement of such development would make providing effective public transit even more difficult than it is now.

Even without expansion of the casinos, attempts to reduce traffic congestion by increasing traffic capacity can be expected to bring about further increases in casino-related traffic. In view of the size of the market, the capability of the casinos to accommodate more visitors, and the willingness of visitors to accept delays and extend their hours of driving, the traffic increase resulting from higher traffic capacity could be large. Widening and constructing roads to increase traffic capacity would double the volume of traffic related to casino use. Previous levels of congestion would again be reached, but with higher volumes of traffic, which would cause interferences and air pollution worse than before.

To reduce traffic congestion, it will be necessary to reduce the volume of traffic. The volume could be reduced if a larger percentage of the travel were made by transit. However, the free choice of transit without restrictions on automobile use is unlikely to cause more than a small percentage of the automobile users to make the shift, even though traffic is congested. Furthermore, even if the shift were large enough to reduce traffic volume initially, additional drivers would eventually be attracted by the improved traffic conditions, and the volume would increase to its former level, despite the increased use of transit. Therefore, in addition to expanding public transit, some form of restriction on auto use would be needed to significantly reduce traffic volume and maintain the reduction.

Curtailing traffic through restrictions on automobile use could result in economic losses to businesses and workers (although economic growth made possible by increased travel could offset the losses). Staging of the transit expansion would have to be planned so that the present traffic system could continue to function during the transition period.

MITIGATION MEASURES

Two kinds of mitigation measures would be most effective in reducing traffic volume: 1) the expansion of public transportation services and 2) restrictions on automobile use. Coordinated management of these two kinds of measures is an important measure in itself. Other measures are improved pedestrian and bicycle facilities and coordination of land use with public transit.

During the past five years, many possible transportation measures for the Lake Tahoe Basin have been analyzed in some detail. Public transit proposals have ranged from a moderate increase in the number of buses to light rail on exclusive lanes in South Lake Tahoe and greatly expanded bus services throughout the basin. Suggestions on the regulation of automobiles have included a user fee on all automobiles that stop in the basin and controls on the roads through the Emerald Bay area on the west shore and the Sand Harbor area on the east shore. A proposal for management has been to establish a single agency, a Tahoe transportation district, to operate public transit and collect the basin user fee. Details of this and other proposals are contained in the reports on the CTRPA Regional Transportation Plan (1977e), the TRPA Regional Transportation Plan (Short Range Element) (1975b), and the Lake Tahoe Basin Nonattainment Plan. The city of South Lake Tahoe is planning to expand its bus and bicycle systems. Possible traffic and transit improvements on U.S. 50 in the South Lake Tahoe area are currently under joint study by the city, El Dorado and Douglas counties, Caltrans, and the Nevada Department of Highways.

The mitigation measures below combine various measures to reduce traffic volume. Measures are considered here to be feasible for mitigating traffic impacts of growth only if they have possibilities of reducing traffic volume. Some road improvements are needed for traffic safety and efficiency, but major road changes or additions are not considered here to be feasible measures for reducing traffic volume.

1. Add more buses and establish basinwide transit agency.

Description. This group of measures would be similar to transit elements of the TRPA short-range plan. Existing bus services would be extended to cover more of the south and north shore areas, and the frequency of service would be doubled. Buses would continue to operate in normal traffic lanes on U.S. 50, where they would be subject to the same congestion and delays as other traffic. Transit passengers would pay a fare. Basin user fees would not be applied, and traffic congestion would be the only constraint on automobile use.

Effectiveness. Negligible, perhaps on the order of a 1 to 2 percent reduction in traffic volume.

Responsibility. Would require agreements between California and Nevada, several counties and the city of South Lake Tahoe to establish transit agency. The transit agency, after its formation, would carry the responsibility for operating the bus system.

Cost. The DeLeuw, Cather & Company (TRPA, 1976a) report for TRPA estimates that "approximately \$5.0 million would be needed over and above existing funds during the period 1977 through 1981." The report states that \$2.2 million

would be available from the federal government, and the remainder would have to be raised locally.

Timing. A five-year plan.

2. Establish light rail service on U.S. 50, a supporting bus feeder system, and a basinwide transit agency.

Description. These measures would be similar to the transit elements of the CTRPA Regional Transportation Plan, but without waterborne ferries or the imposition of a basin user fee. Light rail would be operated in exclusive lanes for U.S. 50 through South Lake Tahoe, and an expanded fleet of buses would be used for feeder services to the light rail line and for improved transit services elsewhere in the basin. A basinwide transit agency would be established. The principal feature of this plan would be that transit could operate during peak periods on U.S. 50 without being delayed by congestion in the traffic lanes.

Effectiveness. Low effectiveness. Might reduce traffic volume by 10 percent, but traffic congestion would remain, and volume would grow again.

Responsibility. Would require agreements between the states, several counties, and the city of South Lake Tahoe to establish the transit agency, after which the agency would be responsible.

Cost. The cost of public transportation improvements, according to CTRPA estimates, would be about \$178 million over a nine-year period. Approximately \$100 million would come from federal, state, and local funds. The remainder would be derived from system revenues or other local funding.

Timing. Improvements are needed now, but could require more than five years to complete.

3. Establish light rail service on U.S. 50, a supporting bus feeder system, a basinwide transit agency, and a basin user fee.

Description. Same as measure 2 above, except that a basin user fee would be added and no fares would be charged on public transit. A fringe parking option would be available to visitors, and greater awareness of available transit services would be promoted. This plan would permit full freedom of choice between automobile and transit, and would depend on traffic congestion alone to divert automobile drivers to transit.

Effectiveness. Moderate; could reduce traffic volume by 15 to 25 percent depending on character of services and management.

Responsibility. Same as measure 2.

Cost. Same as measure 2, but basin user fee would cover balance of cost without requiring transit fares.

Timing. Same as measure 2.

4. Establish light rail service on U.S. 50, local bus services, basinwide management of road system at entry points and internal checkpoints, and basin user fee.

Description. The transit system would be similar to measure 3, except that greater emphasis would be placed on development of flexible and responsive local bus circulation and feeder services. The basin's principal road system would be managed by a single agency (like the National Park Service or some other federal agency, or a joint agency of the city, counties, and states), and traffic would be controlled at entry points to avoid extreme traffic congestion on basin roads. U.S. 50 traffic could bypass on Highways 89 and 88 during peak periods. A user fee would be collected. Passengers would pay no fare to ride transit.

Effectiveness. Could be extremely effective. Could reduce traffic volume by 50 percent or more, but the amount of reduction could be very closely regulated depending upon the degree of control applied at entry points.

Responsibility. Federal government in agreement with states, counties, and the city of South Lake Tahoe.

Cost. About the same as measure 3.

Timing. About the same measure 3.

4. RECREATION

EXISTING CONDITIONS

Federal Recreational Facilities

The U.S. Forest Service is the largest provider of publicly owned recreation in the Lake Tahoe Basin and owns or controls 64 percent of the land. The parts of the Eldorado, Tahoe, and Toiyabe National Forest that fall within the basin are managed together as the Lake Tahoe Basin Management Unit (LTBMU).

A small part of the federal recreational land is designated for "developed" recreational use; the rest has been designated for "dispersed" recreational use. Developed recreational areas have facilities such as restrooms and parking areas that require capital investment, maintenance, and supervision. Dispersed recreational areas are restricted to off-road vehicles, hikers, and backcountry packers (on horse or on foot). The Forest Service provides for use in dispersed-use areas by regulating off-road vehicles, issuing campfire and wilderness permits, constructing off-road parking, and maintaining and improving trails.

As shown on Table 35, the total 1975 recreational capacity of national forest lands (both developed and dispersed) was about 23,000 persons at one time (PAOT) and 2,260,000 visitor days (one person for 12 hours). Expansion of developed facilities in the basin called for by the LTBMU policy plan is expected to provide capacity for an additional 3,000 PAOT by 1990, and 5,000 by the year 2000. Visitor day capacity would reach 2,751,000 by the year 2000. Beyond the year 2000, campsites may be doubled in number, and dispersed recreation may reach 12,000 PAOT.

TABLE 35
RECREATION CAPACITY OF
NATIONAL FOREST LANDS, LAKE TAHOE BASIN, 1975¹

<u>Developed Use</u>	<u>PAOT</u>	<u>Visitor-Days, 1975</u>
Resort lodging/campgrounds	4,910	289,000
campgrounds	1,865	171,700
Picnicking/swimming (9 sites)	5,320	166,400
Organization sites	835	171,700
Total	12,930	798,800
<u>Dispersed Use</u>		
Roads, trails, undeveloped lands, rivers, streams	5,000	982,600
Desolation Wilderness	2,030	203,700
Total	7,030	1,086,300
Summer homes	3,114	274,000
TOTAL	23,074	2,259,100
Winter sports (skiing) (Heavenly Valley)	444,000 skier days	

¹ Excluding use of winter sports, mainly skiing, which, in Heavenly Valley amounted to 444,000 skier days.

Source: U.S. Forest Service, LTBMU Environmental Analysis Statement, 1975.

The LTBMU has recently acquired a number of land parcels, some of which will be developed for intensive use and some for dispersed use. Plans for dispersed-use areas are laid out in the environmental statement for the LTBMU Land Management Plan, Part I (U.S. Forest Service, California Region, 1978b). In general, low-density, dispersed use will be emphasized for the undeveloped parts of the basin except in areas critical to wildlife or where water quality might be degraded.

Dispersed-use areas, in particular, have suffered from overcrowding, and complaints have been received concerning the poor quality of the wilderness experience. Use of the Desolation Valley Wilderness/Primitive Area approaches 2,030 PAOT (U.S. Forest Service, California Region, 1978). To ease the crowded conditions, the Forest Service now limits overnight permits in the area to 700 people per day. To cope with increased use in other dispersed-use areas, the Forest Service has developed plans for regulating off-road vehicles (implemented in 1977), developing trailheads and off-road parking, constructing new trail systems, and expanding visitor information programs.

State Recreational Facilities

State recreational facilities consist of state parks and recreation areas under the jurisdiction of the California Department of Parks and Recreation and the Nevada Parks System. On the Nevada side, half of the Lake Tahoe-Nevada State Park lies within the Tahoe Basin; this facility is administered by the Nevada Parks System. The California Department Parks and Recreation operates the Tahoe State Recreation Area and three state parks, Emerald Bay, D.L. Bliss, and Sugar Pine Point, in the basin. State parks allow camping and picnicking at some sites, but are primarily for wilderness preservation and appreciation. Recreation areas, on the other hand, are developed for more intensive and active uses.

California has recently purchased several parcels on the northwestern side of the lake: a parcel encompassing most of the Burton Creek watershed; 173 acres of land near Ward Creek for recreation; and 4 acres at the Truckee River spillway, called the Fanny Bridge site.

Use of the Lake Tahoe-Nevada State Park is expected to increase in the near future as a result of the influx of service workers into the Reno-Sparks area. There are no immediate plans for improvements.

Recreational Areas Operated by Local Jurisdictions

The city of South Lake Tahoe owns five beaches: El Dorado, Regan, Connally, Barton, and Hartoonian (these last two are leased by the city and are accessible only by boat). El Dorado County Campground is owned by the county but run by the city. This facility consists of 134 campsites limited to four persons each.

Other municipal recreation facilities are a recreation complex and a heated pool operated by the South Lake Tahoe Recreation Department and beaches, parks, tennis courts, bicycle trails, and a community center operated by the Park and Recreation Department of the North Tahoe Public Utilities District. Four lighted tennis courts are located on the east shore at George Whittel High School in Douglas County.

Privately Owned Recreational Facilities

In 1974 visitor days to the south shore area were estimated at 16 million. By 1977 the number of visitor days rose to 18 million (RHA estimates), an increase of 4.3 percent per year. Private recreational facilities such as casinos, campgrounds, marinas, golf courses, boat rentals and rides, the Heavenly Valley ski complex, and other nearby skiing areas, bring many of these visitors to the area.

Gaming facilities in Stateline provide much of the activity at south shore, although many gaming visitors also participate in other activities while in the basin. Visitors to Lake Tahoe participate in an average of 5.2 activities per visit (Economic Research Associates, 1975). Visitors to the south shore area ranked gaming as their favorite activity next to rest and relaxation, and over 85 percent of the visitors surveyed reported that they participated in gaming during their visit (Economic Research Associates, 1975). TRPA estimated casino patronage in 1974 at 13,800,000. Occupancy rates in the south shore area in that year were highest at the casino-hotels and were higher in motels within a quarter-mile radius of the casinos than in those more than a half mile away (TRPA, 1977a). Although gaming remains the most important private attraction and is in principal a year-round operation, visitor levels change with the season; the lower levels occur in October through November and April through May, and the higher levels occur during the ski season between December and March.

The significance of private versus public recreational facilities can be seen by comparing visitor day estimates to the Forest Service (somewhat under 2,260,000 in 1975) with total visitor days (15,000,000 in 1976; U.S. Forest Service, 1978b). As the Forest Service has jurisdiction over 64 percent of the total basin acreage and private parties own 35 percent, much of which is devoted to housing, private recreational facilities are clearly attracting a higher proportion of visitors than public facilities and are providing intensive use of available land and facilities. Conflicts between different visitor groups arise primarily between private and public recreational user. An example of this conflict is the congestion in the south shore casino area, which detracts from enjoyment of the area by nongaming visitors.

IMPACT ASSESSMENT

Question: To what extent will the demand for publicly owned outdoor recreation facilities exceed the supply?

Measurements

	1975	1	2	<u>Growth Scenarios</u>		5
				3	4	
Percent served by Forest Service recreational facilities:						
Peak summer visitors	18	17	13	13	12	11
Impact rating		Low	Medium	Medium	High	High
Annual visitor days	11	10	8	8	7	6
Impact rating		Low	Medium	Medium	High	High

In 1975 the peak summer day visitor population was 130,770, and total visitor days were 20,651,960. By the year 2000, the peak summer population would range from 167,230 under Scenario 1 to 264,520 under Scenario 5; visitor days would range from 26,706,050 in Scenario 1 to 43,345,540 in Scenario 5.

Ratings were derived by comparing year-2000 percentages with 1975 percentages. It was assumed that all available capacity of Forest Service facilities would be used.

The measurements understate the inadequacy of publicly owned recreational facilities for two reasons:

- The planned year-2000 capacity of Forest Service facilities in the entire basin were divided by the projected levels of visitors for the south shore alone (STPUD and DCSID). If north shore visitors were added to the projections, even fewer visitors would be shown to be accommodated by Forest Service facilities.
- Permanent residents compete with visitors for the use of publicly owned recreational facilities. Residents are particularly interested in day-use sites and dispersed use areas. To the extent that local residents preempt use, these facilities will be inadequate to meet visitor demand. Visitors may then increase demand for privately owned recreational facilities particularly under scenarios that involve higher local population levels.

The measurements overstate the inadequacy of publicly owned recreational facilities because state and county parks are not included in the measurement. These facilities are limited in size, and projections of provisions and campsites are not available.

The capacity of ski areas is excluded because only peak summer population levels are measured.

Description

Compared to the 1975 situation, Forest Service facilities would accommodate a smaller percentage of peak summer visitors and visitor days under all scenarios. The remaining percentage would be served by other public facilities, which are limited in capacity, and by privately owned recreational facilities. The demand for privately owned recreational facilities would be greatest under Scenarios 4 and 5.

Critical Implications

Publicly owned recreational facilities will be inadequate under all scenarios. Visitor demand will therefore require substantial increases in the capacity of privately owned recreational facilities. Although landowners, developers and facility operators would benefit financially, new privately owned facilities could have adverse impacts on the aesthetic quality of the basin.

If demand for privately owned recreational facilities were to exceed the supply, prices would be driven up and lower income groups would be excluded.

Ultimately, recreational use may become so intense that the quality of the recreational experience will be degraded. Greater occupancy of recreational sites may mean greater noise, less solitude, and damage to sites themselves. Would-be visitors may then stay away, thereby decreasing visitor demand and, in turn, stabilizing the recreational quality of the basin. Experience in Yosemite, Yellowstone, and other national parks, however, suggests that visitors will continue to visit an area even when significant crowding and degradation occur.

Visitors and residents may choose to use recreational facilities outside of the basin (e.g., in Alpine County), thereby transferring impacts to other areas.

Question: To what extent will the quality of the recreational experience be degraded?

Measurements

	1	2	<u>Growth Scenarios</u>		5
			3	4	
Access to the lake shoreline	Medium	High	Medium	High	Extreme
Noise level	Low	Medium	Medium	Medium	High
Traffic congestion	High	Extreme	Extreme	Extreme	Extreme
Air pollution	Low	Medium	High	Medium	Extreme
Natural setting	Medium	High	High	High	Extreme
Availability of public outdoor recreational facilities	Low	Medium	Medium	Medium	High
Water quality in lake	Medium	High	High	High	Extreme

Ratings are based on quantitative and qualitative measurements made in other sections of this report. They assume that the natural environment is a key factor in the quality of the outdoor recreational experience in the Lake Tahoe Basin and that degradation of the individual natural components will reduce the quality of the experience.

Description

Public access to the lake shoreline is already limited. Further development of private property along the shorezone will reduce public access and preclude these lands from eventual acquisition for public use.

Noise levels will increase in proportion to population and traffic and will affect the recreational experience in forest and lake lands adjacent to developed areas. Reductions in water quality in the Lake Tahoe Basin will result from development of SEZ lands and lands with high erosion potential.

Adverse impacts on other aspects of the outdoor recreational experience, including natural setting, availability of recreational facilities, and water quality will increase as development intensifies. Refer to specific sections for further discussion.

Critical Implications

Reductions in quality and availability of outdoor recreational experiences are likely to reduce the attractiveness of the basin at the high growth levels reached in Scenarios 4 and 5. At the interim growth levels (Scenarios 2 and 3), the attractiveness of the basin will probably be diminished for some of the visitor and resident population.

MITIGATION MEASURES

1. Adopt and enforce ordinances to protect SEZs and low capability lands from development. (See mitigation measure under "Water Resources and Water Quality.")
2. Establish National Scenic Area. (See mitigation measure under "Visual Resources.")
3. Adopt nonattainment plan to reduce air pollution and traffic congestion. (See mitigation measure under "Air Quality.")
4. Adopt noise standards to prevent increases in noise near recreation areas. (See mitigation measures under "Noise.")
5. Acquire land for public recreational use.

Description. Through Forest Service and California and Nevada state parks systems, establish active acquisition programs for identifying and purchasing privately owned parcels.

Effectiveness. The effectiveness of this measure is limited by willingness of owners to sell and the high costs of purchase. The Forest Service already has a program for planned acquisition through 1983. The state parks systems could develop similar programs. Could increase access to lake if land were acquired in shorezone.

Responsibility. U.S. Forest Service, California Department of Parks and Recreation, Nevada State Parks Department.

Cost. Would depend upon cost of land and is likely to be high.

Timing. Land must be purchased before development takes place.

5. PUBLIC SERVICES/FISCAL CONCERNS

EXISTING CONDITIONS

Health

Barton Memorial Hospital in South Lake Tahoe is the only hospital in the Lake Tahoe Basin. The hospital, with 62 licensed and 28 unlicensed beds, serves the population in the southern part of the basin from Spooner Summit to Strawberry Hill. Half of the patients are tourists, and of the local patients, nearly all are from California. There is one skilled nursing facility in the area, which is consistently full, and patients must often be placed in facilities outside the area. Other health services such as mental health, education, drug abuse and alcoholism clinics, and rehabilitation services are provided by El Dorado and Placer counties.

Schools

The Lake Tahoe Unified School District serves the California side of the south shore area, and the Douglas County School District serves the Nevada site. The Lake Tahoe district has five elementary schools, one intermediate school, and one senior high school. In 1976-1977, 4,257 students were enrolled and 169 teachers were employed. A new intermediate school and new high school area envisioned, but neither is funded at present. The Douglas County district served 705 students in 1977-1978.

The Lake Tahoe Community College District, which operates out of a converted hotel in South Lake Tahoe, had an enrollment in 1977 of 1,450 students (CTPA, 1977).

Law Enforcement

In the city of South Lake Tahoe, the ratio of sworn police personnel to permanent residents is 1.7 per 1,000, slightly below the national average for rural areas of 2.1 per 1,000. In Douglas County, the ratio is 3.1 per 1,000. However, the ratios of personnel to actual population served are much lower, especially during peak visitor periods.

The El Dorado County Sheriff Department maintains a substation in South Lake Tahoe to police the unincorporated areas around Lake Tahoe within county boundaries.

Fire Protection

The south shore areas are provided with at least a minimum level of fire protection. The Insurance Services Office recommends that rural fire protection be maintained at a rating of 8 or better on a scale of 1 to 10 (with 1 being the best service). The populated areas of the south shore have services rated at 5, 6, and 7. However, water flow and response time are problems in a few areas, and

development of subdivisions at some distance from stations may make building new stations necessary. (CTRPA, 1977a).

The U.S. Forest Service and the Nevada State Department of Forestry have fire protection jurisdiction throughout the basin to control forest and range fires.

Solid Waste Management

Both the city of South Lake Tahoe and El Dorado County have contracted with the South Tahoe Refuse Company to provide collection and disposal service in the southern portion of the basin.

The South Tahoe Refuse Company, which serves 13,000 customers in the south shore area, operates a fleet of packer trucks that makes regular collections and delivers solid waste to a transfer station near the intersection of U.S. Highway 50 and Highway 89. The transfer station also accepts waste from citizens who haul their own waste to the site.

Garbage and solid waste from the transfer station are transported 97 miles to a 112-acre sanitary landfill east of Gardnerville in Douglas County, Nevada. Leased by Douglas County from the Bureau of Land Management, the landfill is operated and maintained by the South Tahoe Refuse Company.

IMPACT ASSESSMENT

Question: To what extent will capacities of health care systems schools, and fire protection and police services be adequate to meet demand?

Measurements

	1	2	<u>Growth Scenarios</u>		
			3	4	5
Summer population, percentage increase, 1978 to 2000					
STPUD					
Residents	8.8	36.1	26.6	7.2	45.8
Overnight visitors	19.5	72.8	50.6	22.5	72.3
Day visitors			Unallocated		
DCSID					
Residents	28.1	37.8	127.9	179.5	165.3
Overnight visitors	83.0	78.0	188.1	431.2	345.9
Day visitors			Unallocated		
Total south shore					
Residents	12.7	36.5	47.1	42.2	70.1
Overnight visitors	30.0	73.6	73.4	90.2	117.7
Day visitors	38.6	73.7	73.4	90.2	117.7
Total	27.5	62.7	65.7	76.1	103.6

Demand for these services would, in general, increase in proportion to rates of increase of resident and/or visitor population.

Description

Health. Under all scenarios, demand for health care would exceed the capacity of the present system. The most pressing problem is the need to expand Barton Memorial Hospital. At present, during peak demand, acute-care bed capacity is exceeded. License for 28 additional acute-care beds has been requested, but even if approved, the facility could still only serve a low-growth population. (U.S. Department of Health Education and Welfare Health Planning Guidelines have established a standard of four acute-care beds per 100 population.) The emergency room is overcrowded, and space is needed to expand the pharmacy and for additional offices, hospital support services, and equipment.

Demand for skilled-nursing and intermediate-care beds, which would increase with a rise in resident population, at present exceeds supply.

The private sector is able to handle most primary-care demands, except for minor emergency care, which is provided by the hospital emergency room. According to the El Dorado County Health Department, county-run detection and prevention clinics could only accommodate a 10 percent increase in user population. Thus any growth beyond Scenario 1 would necessitate an expansion of services.

Health education programs could accommodate a 35 percent increase in user population; the counseling programs could accommodate only a 10 percent increase. An increase of 75 percent or greater in demand for alcoholism and drug abuse services would require a doubling of space. Mental health services at present lack an in-patient facility.

Changing policies at the state and federal level make it difficult to predict future funding for El Dorado County Health Department programs. The state funds 90 percent of the mental health programs; the state and federal governments fund 50 percent of drug abuse and alcoholism programs. If funding changes, adequacy of the programs to meet demand could also be affected.

Although the state and federal agencies negotiate programs with each county, they are held to population guidelines that make it difficult to allow for the larger number of visitors to the Lake Tahoe Basin.

Schools. The number of school-age children, estimated at 13 percent of resident population, would increase under all scenarios. Facilities and level of staffing in the Lake Tahoe Unified School District in 1977 could accommodate an increase of 1,151 students. Under Scenario 3, this capacity would very nearly be reached. Under Scenarios 2 and 5, increases in school-age children would exceed the district's capacity.

The existing and planned facilities in the basin part of Douglas County School District could accommodate 100 to 200 additional students. Under every scenario, the estimated increase in school-age children would exceed this capacity.

Because community college attendance is elective, demand for college courses is more a function of the type of instruction offered and local interest in higher

education than of population. The facilities of the Lake Tahoe Community College could accommodate 1,000 additional students. Assuming the current ratio of college students to permanent residents in the college district, the increase in students under the five growth scenarios would range from 90 to 573, well below the capacity of the school facility. The ratio of students to permanent residents could change in the future, however, as residents become more familiar with the newly established college.

Law Enforcement. Demand for law enforcement services would increase under all scenarios. However, population growth would not fully account for all increases in service demand. Location and density of development and differences in land uses may also affect demand.

Fire Protection. Demand for fire protection services would increase under all scenarios. The number of additional structures, density of development, condition of the buildings, location of growth, and land use types would determine demand.

More structures would not necessarily mean that the fire department would have to increase staff and equipment to maintain present levels of service. Infilling or moderate growth adjacent to already developed areas could be served by existing facilities without lowering the level of service. Service may be constrained more by distance from existing stations, poor accessibility, inadequate water supply, and low water pressure than by equipment or personnel. Thus, the scenarios with lower levels of growth may require little expansion of facilities to maintain existing service levels if development occurs primarily as infilling and if water supply and pressure problems are solved (per CTRPA, such problems exist in areas of the city of South Lake Tahoe).

Wildland fire protection demands will also increase under all scenarios, primarily because of the increased fire risks as more people use these lands. Although the area under forest service protection will be reduced as vacant land is developed, the increased numbers of people using wildland areas will more than make up for this change.

Critical Implications

Under all scenarios, demand for health services would exceed supply, and consequent overcrowding could reduce quality of care. Areas of concern are the shortage of acute-care beds, and the shortage of space to expand Barton Memorial Hospital. More intermediate and skilled nursing facilities and an in-patient mental health clinic are also needed.

Under Scenarios 2 and 5 for the Lake Tahoe Unified School District and under all scenarios for Douglas County School District, enrollments would exceed capacity, and additional classrooms and staff would be required. However, as capacity estimates are based on higher levels of students per classroom than currently exist, growth in STPUD under Scenario 3 could result in higher student-teacher ratios. As estimates do not consider distribution, capacity of individual schools may be exceeded even though enrollment growth estimated under a scenario may be less than the districtwide capacity. Where rising enrollments are not met by added facilities and staff, overcrowded classrooms could adversely affect the quality of education.

In both STPUD and DCSID, growth is likely to require additional personnel and equipment to maintain present levels of law enforcement services. Since the provision of adequate law enforcement services is currently constrained during peak visitor periods, this situation is likely to continue under all scenarios unless service characteristics are improved above existing levels. If personnel and equipment required to maintain existing quality of service are not provided, a longer time may be required to respond to calls for service, and noncrime service calls may be given lower priority.

In both STPUD and DCSID, the higher growth scenarios may require increased equipment and personnel to maintain present levels of fire protection service. For example, if development continues in the vicinity of Mountain View Estates in California, an additional station for the Lake Valley Fire Protection District may be needed (CTRPA, 1977a). Maintenance of adequate service levels could also depend upon extension of water supply to areas of future development. Where facilities required to maintain existing levels of service are not provided, the probability of structural and personal damage from fire would increase, possibly resulting in poorer insurance ratings and higher premiums.

Question: To what extent will solid waste collection and disposal systems be affected?

Measurements

	1978	1	2	<u>Growth Scenarios</u>		5
				3	4	
Volume of solid waste collected at South Tahoe Refuse Co. transfer station (thousands of cubic yards per year)	186.5	222.0	279.9	292.8	305.7	353.1
Percent increase over present volume		19	50	57	64	89
Impact rating		Medium	High	High	High	Extreme
Truck trips per day to Gardnerville landfill	7	9	11	11	12	14
Impact rating		Medium	Medium	Medium	Medium	High
Additional acres of Gardnerville landfill depleted		5.7	7.2	7.6	7.9	9.1
Impact rating		Low	Low	Low	Low	Low

Volumes represent only solid waste from residents and overnight visitors and collected and transferred by the South Tahoe Refuse Company (contributions from day visitors, the sewage treatment plants, and those who haul their own solid waste

to the landfill are excluded); therefore, the volumes are conservative figures. Contributions by overnight visitors are based on Recht-Hausrath & Associates estimates of visitor days. Amounts of solid waste generated daily by visitors and residents may differ; however, as information on this difference is not available, equal per capita generation factors have been assigned.

The depletion of the landfill (acres filled) is attributed to solid waste from the Lake Tahoe Basin, which accounts for 85 percent of the waste accepted at the disposal facility (15 percent originates in Alpine County and the Carson Valley area of Douglas County).

Description

The amount of solid waste collected and disposed of at the Gardnerville landfill is directly proportional to the population (permanent residents and overnight visitors). Accordingly, the volume of solid waste produced under Scenario 1 would increase 19 percent over existing conditions; under Scenario 5, the increase would be 89 percent. The impact of such increases would be felt primarily in the city of South Lake Tahoe, where the waste must be compacted and loaded onto the transfer trailers.

The transfer station in the city of South Lake Tahoe is operating near capacity because of inefficient design. An increase in collections would probably increase the incidence of traffic back-up and packer delay. Growth projected under Scenarios 1 through 4 would require expansion of the existing facility to handle the resulting increase in volume. Volumes under Scenario 5 would be so great that another facility of almost equal size would have to be considered. South Tahoe Refuse Company is proposing to expand and improve this transfer station, although it is uncertain how much more solid waste such modifications would allow the facility to accommodate.

The number of truck trips to the Gardnerville landfill is already of concern to neighbors and CTRPA. The trips originate in a high density, highly traveled area. The adverse impacts include noise and traffic congestion. Although the number of trips per day may be relatively small, the trips occur between 7 a.m. and 3 p.m., which means more than one trip every hour.

Greater volumes of solid waste would require more frequent pick-ups, larger work crews, greater use of the compactor, and more trips of the transfer trailers to Gardnerville. The two biggest cost components of solid waste disposal are labor and transportation. Labor accounts for 80 percent of the cost of collection. The daily cost of fuel for trips between the transfer station and the disposal site is \$80. As operations are expanded to meet greater volumes, such costs will continue to rise and are likely to be passed on to the customers.

Under the 20-year time frame for the alternative growth scenarios, it is unlikely that the Gardnerville landfill would reach capacity.

One local benefit may indirectly result from increased solid waste volumes, namely, the feasibility of an expanded resource recovery and recycling program increases. At present, over 29,000 tons of solid waste are recovered each month. If this amount increases, the number of truck trips to the Gardnerville landfill may be reduced, and fewer acres of landfill may be depleted per year. In

1974 South Tahoe Refuse Company exported paper, cardboard, and selected materials to the Sacramento-Stockton area. The actual cost of segregating and transporting these materials was greater than the revenues received from their sale, but the entire operation was profitable because of savings in export from the Lake Tahoe Basin to Gardnerville.

Critical Implications

The most critical implication of growth for solid waste management is the ability of the transfer station to handle projected volumes efficiently. If the facilities are not expanded, traffic backups and congestion will occur more frequently. The company is seeking to correct these problems by expanding and redesigning the facility. CTRPA is reviewing the request and has identified two issues: first, part of the site is in a stream environment zone where construction activity may impair water quality and remove valuable wildlife habitat; second, an expanded station may exacerbate traffic congestion in this heavily traveled area.

Another area of critical concern, although not directly associated with population growth, is the upcoming contract negotiation between South Tahoe Refuse Company and Douglas County for the company to continue operating the Gardnerville landfill. The Douglas County Board of Commissioners awarded the South Tahoe Refuse Company the right to operate and maintain the landfill in July 1970. In 1975 the contract was renegotiated and extended for five years, at which time the lease would be reviewed. Should Douglas County decide not to accept waste from the basin, El Dorado County would have to implement the contingency plan of its Solid Waste Management Plan, which calls for transporting waste 140 miles over Echo Summit to the regional landfill at Placerville-Union Mine. This alternative is undesirable for the following reasons (CTRPA, 1977a):

- acceptance of basin waste would soon deplete the capacity of the site
- transfer of waste to the site would cause traffic delays and be hazardous during the winter
- operational costs such as for fuel and transportation would increase significantly.

The county Solid Waste Management Plan does not call for considering alternative sites until 1980. Study, evaluation, and preparation of landfill sites will require at least two to three years. Factors which will greatly reduce the availability of alternative sites in the future include (CTRPA, 1977a):

- a shortage of undeveloped areas suitable for landfills large enough and close enough to population concentrations
- escalating fuel and transportation costs
- more stringent criteria for the selection of sites arising from more complete knowledge of relationships of air, water and land resources
- adverse community response to siting of nearby sanitary landfills.

Thus, if the lease on the Gardnerville site is not renewed, the county will be forced to haul waste to the regional landfill for at least three years until an alternative site can be prepared.

Question: How will per-unit costs to provide public services be affected? How will generation of per-unit revenues to pay for public services be affected?

Measurements

	<u>Growth Scenarios</u>				
	1	2	3	4	5
Per-unit costs to provide:					
Schools	No significant variation among scenarios. Operating costs (majority of total school costs) roughly correlate with number served. Needed new facilities likely to increase per-unit capital costs.				
Law enforcement	No significant variation among scenarios. Generally, per-unit costs correlate with population increase and are also influenced by the socio-economic makeup of residents and visitors.				
Fire protection	More growth probably results in greater efficiency, allowing better service or lower per-unit cost, except for wildlands fire protection, where per-unit costs are likely to increase with growth in wildlands usage.				
Water and wastewater services	No new capital facilities required to provide additional water. Significant per-unit cost variation unlikely among Scenarios 2 through 5. for water services. No significant per-unit cost variation among scenarios for expanded wastewater treatment facilities. Most costs paid by federal/state sources. If secondary wastewater treatment replaces tertiary treatment, per-unit costs likely to decline in STPUD for all scenarios. Infill of service areas allows significant cost savings to be realized, if growth locates to use excess capacity.				
General government	Growth may result in cost efficiencies for some components of government services, but may not for others.				
Transportation	Would depend on system characteristics and public/private distribution of costs.				

		Growth Scenarios				
		1	2	3	4	5
Revenues per-unit of service from:						
Property Tax						
Increase in property value	Generally higher	Higher for DCSID; more moderate overall for STPUD	Relatively more moderate for both areas	Generally higher; higher in STPUD than DCSID	Relatively more moderate for both areas	
		Higher property values per-unit of service occur where lower growth results in a competitive market and higher housing prices.				
Sales tax		Relationship between growth and sales tax revenues is the same for all scenarios. Scenarios which estimate an increased share of commercial floor space in Nevada would have higher per unit sales tax revenues. Due to different tax exemptions, comparable sales generate only about half as much (55 percent) revenue in California.				
Gaming levies		Relationship between growth and gaming tax revenues is the same for all scenarios. However, these revenues are only available to service jurisdictions in Nevada, and variations among scenarios depend on amount of increased gaming relative to share of growth in Nevada.				
Transient occupancy tax and room tax		No significant difference among scenarios.				
Special assessments		Higher growth scenarios provide the ability to build out all vacant land where special assessments now exist, thereby providing the ability to collect these revenues. Medium and lower growth scenarios would generate less revenue, depending on the location of growth.				
State and federal subventions		Undeterminable due to difficulties in predicting future levels of state revenues and procedures for their allocation.				
User fees		No significant differences among scenarios. Revenues would increase in proportion to growth and associated service demands.				

Description

The major fiscal issue related to growth under the five scenarios is whether there are significant differences in the quality, quantity, and cost of public services provided. The question of whether growth pays for itself usually concerns whether providing public services to new users increases the costs to all users without increasing or improving service.

The fiscal effect of new development is determined by five variables:

- the make-up of existing population and land use
- the type of new development (scale, type, location, value of land use)
- the state of capital facilities in the service districts at the time the demand for service increases (i.e., the presence or absence of unused capacity)
- the laws and policies concerning the types of taxes that are used to pay for public services
- the policies that service districts apply to the setting of user charges and other nontax revenue sources.

It is possible to describe significant differences among scenarios regarding these cost and revenue considerations.

Major considerations made in assessing impacts on costs are: a) the distribution of total costs between fixed costs (costs associated with the use of resources, such as land, buildings, and machinery which cannot be varied for a given set of capital facilities) and variable costs (costs of resources such as labor and supplies which can be varied), and b) the capacity at which the existing facilities are operating.

The major consideration made in assessing impact on public service revenues is the extent to which the ability to collect revenues varies as a function of a) the overall growth under a scenario, and b) the distribution of growth among areas within the south shore.

Critical Implications

Fiscal differences among the scenarios can be evaluated in terms of which scenarios appear to be "better" and why such conclusions can be reached. Better implies having greater ability to generate revenues to fund anticipated service costs. This analysis considers the concept from a regional perspective.

Lower growth scenarios would contribute to a better fiscal outcome in south shore where:

- required new capital facilities would have higher than average unit costs
- expanded service output would result in diseconomies of scale in service delivery
- less growth would result in a constrained supply relative to demand, resulting in higher property values and property tax base.

Higher growth alternatives would contribute to a better fiscal outcome in south shore where:

- expanded service output would provide economies of scale in service delivery
- efficiencies would result from infill development in areas having excess capacity
- growth would allow collection of revenues as anticipated for retirement of existing bonded indebtedness.

There are also situations where more or less growth per se is not likely to have any significant fiscal implications.

An assessment of growth-related fiscal impacts must consider the location of service demands and the distribution of revenues. Where growth occurs within public service districts with available capacity, not only would efficiencies increase and advantage be taken of revenues sources (as described above), but defaults on existing bonded indebtedness would be prevented. Problems with meeting such commitments could be most severe for districts where existing indebtedness is secured by the land and is being repaid by special assessments on landowners. Included among the districts with the potential for such problems would be the Round Hill General Improvement District (presently developed to about 30 percent of original acreage or 50 percent of present non-general forest acreage), the Tahoe-Douglas General Improvement District (about 80 percent developed), the Kingsbury General Improvement District (about 50 percent developed), and portions of STPUD (primarily county areas).

Whether growth takes place in California or Nevada is important in determining fiscal impacts. Under Scenarios 1, 3, and 5 the shares of south shore growth are equally distributed between the states. The smallest share of growth allocated to Nevada occurs under Scenario 2. Under Scenario 4, a greater share of south shore growth takes place in Nevada, which would result in a relatively greater ability to generate per-unit sales tax and property tax revenues there and, more importantly, because of the availability of gaming revenues, would result in a better match between tax revenues and service demands. As with most economic base activities, revenues from gaming have lesser service costs directly associated with them. The proportionately greater service costs associated with the population can best be matched with revenues if located within jurisdictions where basic revenue sources can be used. Further, the availability and use of gaming revenues becomes even more important with the passage of measures limiting revenues from property tax sources. With current tax laws, at maximum rates, comparable properties generate only about half (55 percent) as much revenue in California. For new development, service districts in California benefit less, since increases in assessed value are shared by all county tax jurisdictions. Also, in California, Proposition 13 limits the extent to which future appreciation of property can be taxed. In Nevada, passage of Question 6 would make procedures similar in both states.

Similar reasoning applies to the spillover of employee households into the Carson Valley portions of Douglas County to the extent that gaming revenues are available to cover service costs in the valley. Although it is unclear whether it would be more efficient to serve the spillover population in south shore or in Carson Valley, it is reasonable to conclude that it is better to serve it in Carson Valley than at some other non-south shore location that does not have the tax base of gaming revenues.

Taken together, these generalizations support very qualified statements that the preferred scenario from a fiscal perspective is one which:

- allows at least some growth to minimize the inefficient use of existing facilities and to prevent default on existing bonded indebtedness
- directs that growth to locations where excess capacities exist, at least to the greatest possible extent (available capacities for the many different services may not coincide)
- directs proportionately more growth to Nevada than to California.

MITIGATION MEASURES

Health

The two nationally mandated health systems agencies that serve the area, the Golden Empire Health Systems Agency and the Greater Nevada Health Systems Agency, have adopted plans for improving health care. Any mitigation measures recommended as a result of the proposed facilities may be required to be consistent with these plans.

1. Expand Barton-Memorial Hospital to twice its present size.
2. Construct primary/intermediate care clinic.
3. Expand county health services programs and encourage volunteer services.

Schools, Law Enforcement, Fire Protection, and Other Services (Fiscal Concerns)

4. Ensure that new development locates to take maximum advantage of existing service capacities.
5. Adopt system of regional tax-base sharing.
6. Coordinate regional land use planning and capital facilities planning and budgeting.
7. Require developers to provide infrastructure and major service facilities and to contribute funds for such improvements.
8. Consolidate service districts.
9. Institute double sessions or year-round school operations to reduce need for additional school facilities.
10. Use volunteer personnel for law enforcement and fire protection.

Solid Waste

In California, pursuant to the Solid Waste Management and Resource Recovery Act of 1972 (Government Code, Section 66700 et. seq.), each county is responsible for the preparation of a solid waste management plan that is comprehensive, coordinated, and consistent with state policy. The El Dorado County plan was approved by local jurisdictions in the basin, but it is now being revised to satisfy comments from the State Solid Waste Management Board. Essentially, the board is concerned that Douglas County might not renegotiate the lease to use the Gardnerville facilities, and that El Dorado County has not considered alternatives other than hauling to the Placerville-Union Mine site.

The El Dorado County Solid Waste Management Plan sets forth goals for collection and disposal of solid waste and identifies short-, medium-, and long-term measures toward those ends. In Nevada, pursuant to the Solid Waste Disposal Act of 1971 (NRS 444.440-.620), each municipality is required to prepare a solid waste management plan. In largely unincorporated areas, such as Douglas County, the county is responsible for developing and implementing the plan. The plans for these two jurisdictions are primarily operational and are based on state laws. They are currently being reviewed by the Division of Environmental Protection. The implementation of any of the following mitigation measures should be compatible with the goals and objectives of these plans.

11. Expand the transfer station in the city of South Lake Tahoe.
12. Encourage recycling and resource recovery efforts by the solid waste franchise operator.
13. Initiate public education and volunteer programs to reduce amount of solid waste generated, promote a clean, litter-free community, and achieve the state goal of a 25 percent reduction in waste going to the landfill.
14. Construct transfer station in Nevada.

6. UTILITIES

EXISTING CONDITIONS

Water

Water Supply. The controlling document for water supply and use in the Lake Tahoe Basin is the California-Nevada Interstate Compact, which was adopted by California in 1970 and by Nevada in 1971. The agreement provides for the establishment of a total gross annual diversion from all natural sources, including groundwater in the Lake Tahoe Basin, of 34,000-acre feet. Of this total annual diversion, 23,000 acre-feet are allocated to California, and 11,000 acre-feet are allocated to Nevada. Water from outside the basin and reclaimed wastewater are not considered part of the total annual diversion.

In the Lake Tahoe Basin, municipal systems provide water for domestic use and fire protection. There are no major industrial or agricultural water demands within the basin. At present, 66 major water purveyors provide water to the population of the Lake Tahoe Basin. Of these water purveyors, 24 divert water directly from Lake Tahoe for part of the year. The remaining water purveyors draw from wells, springs, creeks, and other small lakes in the basin. The available water supply for STPUD is estimated to be 12,000 acre-feet per year, based on consumptive use rates and allocations of water throughout the basin. STPUD derives its water supplies from surface water, diversions from Cold Creek, and groundwater pumped from eighteen wells. In 1977 Cold Creek diversions accounted for 36 percent of the water supplied and were a fairly constant contribution on a year-round basis (with slight increases during peak summer demands). The remaining 64 percent was obtained through groundwater pumpage.

Limitations on water use have been imposed by the California-Nevada Interstate Compact. To supplement available supplies within the Lake Tahoe Basin, the U.S. Bureau of Reclamation has completed a series of feasibility studies of projects to import water supply. Alternatives investigated included diversions and import from the North Fork American River, Caples Creek and Silver Fork American River, and the Rubicon River. Tunnel and pipeline systems have been studied for each of these potential sources. Additional schemes to augment water supply proposed by the U.S. Bureau of Reclamation involved reducing evaporation, supplementing in-basin storage facilities, and increasing storage capacity in Lake Tahoe.

Pyramid Lake has become a central issue in the management of water resources of the region. Pyramid Lake is the terminus to the Truckee River, and as a result of extensive upstream water uses, evaporation exceeds inflows to the lake. The Newlands Project, operated by the Truckee-Carson Irrigation District (T-CID), diverts water from the Truckee River for several uses, including storage in the Lahontan Reservoir. Between 1928 and 1968, the storage volume in Pyramid Lake steadily declined from an elevation of more than 3,845 above mean sea level to less than 3,790 feet. Although the California-Nevada Interstate Compact allocates 30,000 acre-feet per year of water to be used on the Pyramid Lake Indian Reservation, it does not stipulate any measures for maintaining the level of Pyramid Lake.

In 1972 the U.S. District Court ordered the Department of Interior to perpetuate a flow of 385,000 acre-feet per year to Pyramid Lake. However, because the average flow of the Truckee River at the Derby Dam is 475,000 acre-feet per year, full water deliveries cannot be made to both Lahontan Reservoir and Pyramid Lake. The Department of Interior responded with a plan to terminate its contract with T-CID and eliminate most Truckee River diversions to the Newlands Project. The Justice Department then filed a suit to establish the rights of the Pyramid Lake Indians to the Truckee River. Legal proceedings concerning this issue are in the courts.

Water Use. Present water demands in the Lake Tahoe Basin are for domestic and commercial use. The California State Water Resources Control Board (SWRCB) is completing a study on the extent and type of water use. According to the preliminary results of the study, water use in 1977 on the California side of the Lake Tahoe Basin is 11,000 acre-feet per year. Of this total, roughly 7,200 acre-feet are used in the STPUD service area. Water use for the Nevada part of the basin has been between 5,600 and 6,000 acre-feet over the past six years.

According to the study, previous assumptions regarding use distribution may be inaccurate. Earlier analyses of residential water use indicated that 75 percent of water supplied resulted in wastewater flow, but recent data indicates that up to 50 percent of water supplied is used consumptively for landscape irrigation or lost through evaporation and export of wastewater. Thus, as actual use approaches specified allocations, water supply may become a growth-controlling factor more rapidly than originally anticipated.

Wastewater Treatment

See discussion of "Existing Treatment Facilities" in "Wastewater Management Alternatives."

Energy

In the Lake Tahoe Basin, the expansion of year-round recreational facilities has rapidly increased the demand for energy. During the early boom period of ski resort and casino development, power outages were not uncommon, but today, because of the importance of the tourist industry, a sufficient and reliable energy supply is critical to the economy of the basin.

Harsh weather is the main threat to a reliable supply of electricity. Severe winter weather can cause transmission and distribution failures and may cause power outages in some service areas. In the past, outages have been short and have not affected large operations, such as hospital, ski resorts, casinos, or the facilities of STPUD, which have their own emergency generating systems.

Natural gas is supplied by the Southwest Gas Corporation, which distributes it to the north, east, and west shores of the lake. The company also provides natural gas to CP National, which serves the California portion of the south shore. Southwest Gas officials feel gas supplies are adequate until the winter of 1980-1981. At that time peak demands are expected to equal, if not surpass, the capacity of the system. Currently, the design capacity of the system is exceeded two to five times per year (Jauregui, pers. comm.).

IMPACT ASSESSMENT

Questions: To what extent will available water supply be sufficient to meet demand?

Measurements

	1978	1	2	<u>Growth Scenarios</u>		5
				3	4	
STPUD						
Available water supply (acre-feet per year)		12,000	12,000	12,000	12,000	12,000
Water use (acre-feet per year)	8,000	9,500	14,850	12,180	9,460	15,120

	1978	1	2	Growth Scenarios		5
				3	4	
DCSID						
Available water supply (acre feet per year)	All water diversions in Nevada are appropriated by the State Engineer. Thus, available water supply is determined on a case-by-case basis as each application for a water right is submitted.					
Water use (acre-feet) per year)	2,276	3,020	3,000	5,560	9,450	8,940

The California-Nevada Interstate Compact appropriates 23,000 acre-feet per year of water for use in the California portion of the basin. Assumptions concerning use of water are as follows:

- 2,550 acre-feet of water rights will be acquired by the U.S. Forest Service for present and future use
- 500 acre-feet will be depleted due to current Forest Service activities, including lake storage and stream flow enhancement
- 600 acre-feet will be exported through sewer infiltration
- 350 acre-feet will be reserved for California to use for parks, recreation, and erosion control.

According to a California SWRCB study on water use, these are reasonable assumptions based on historic water use and demand. The assumed allocations total 4,000 acre-feet per year. The amount remaining for use is 19,000 acre-feet per year, of which 12,000 acre-feet, would be available for the south shore area, 4,110 acre-feet for the west shore, and 2,890 acre-feet for the north shore.

Current annual water diversion for use within the Nevada portion of the Lake Tahoe Basin is estimated by the Department of Water Resources to be 5,720 acre-feet per year. Some 2,276 acre-feet per year of that water use is for the DCSID service area.

The first step in deriving figures for water use is to determine average day wastewater flow from maximum day flows that are already known. The ratio between the maximum day flow and the average day flow is called the peaking factor. Peaking factors under the different scenarios are indicated below.

	1	2	Growth Scenarios		5
			3	4	
STPUD	1.5	1.3	1.4	1.5	1.3
DCSID	1.6	1.6	1.3	1.1	1.1

Dividing the maximum day flows (shown in Table I of the "Summary") by the above factors yields the average day wastewater flow.

Water use is determined from the average day wastewater flow through another ratio; namely, water use to average day wastewater flow. For STPUD this ratio is 1.75, meaning that 57 percent of the water used was converted to wastewater flows, and 43 percent was used consumptively. For DCSID the ratio was 1.4, that is, 71 percent of the water used became wastewater flow.

Multiplying these ratios by the average day wastewater flow yields water use.

Description

For the STPUD service area, water use at the current rate of use is projected to exceed available water supply under Scenarios 2, 3, and 5. If rates of use increase as a result of higher occupancy rates or increased consumptive use, water use may exceed available water supply under Scenarios 1 and 4 also.

Water use under Scenario 3 would be 50.5 percent of the 11,000 acre-feet per year of water allocated to the Nevada portion of the basin under the Interstate Compact. Water use under Scenarios 4 and 5 would be over 80 percent of that allocation. A significant amount (nearly 40 percent, based on recent trends) of the water supply allocated to the Nevada portion of the basin would be used by DCSID under Scenarios 3, 4, and 5.

Critical Implications

Demand in excess of available water allocation (Scenarios 2, 3, and 5) could make attractive the importation of water from outside the basin, the redistribution of water within the basin, or changes in state and federal policies to allow reuse of reclaimed water for irrigation (in order to increase the potable water supply).

Under Scenarios 3, 4, and 5, water use in DCSID could exceed available water allocation.

Question: What will be the required treatment plant capacities at various levels of growth?

Measurements

	1978	1	Growth Scenarios				5
			2	3	4		
Number of Sewer Units							
Housing							
STPUD	49,749	59,696	85,065	72,380	59,696	85,065	
DCSID	9,552	14,886	14,886	25,392	35,897	35,897	
Hotel/Motel							
STPUD	8,195	9,295	10,527	11,363	9,295	12,375	
DCSID	2,431	3,531	3,531	5,599	11,176	8,096	
Commercial							
STPUD	5,439	6,468	8,379	7,497	6,027	8,526	
DCSID	1,029	1,911	1,617	2,793	4,851	3,969	
Campsites							
STPUD	11,102	1,284	1,465	1,465	1,465	1,465	
DCSID	360	619	690	690	690	690	
Casinos							
DCSID	12,250	13,300	13,300	16,800	21,000	21,000	
Total							
STPUD	64,485	76,743	105,436	92,706	76,483	107,431	
DCSID	25,622	34,247	34,024	51,274	73,614	69,652	
Plant capacity required in mgd (max. day)							
STPUD	5.80	6.91	9.49	8.34	6.88	9.67	
Reserve capacity	.36	.36	.36	.36	.36	.36	
Total	6.16	7.27	9.85	8.70	7.24	10.03	
DCSID	2.3	3.08	3.06	4.61	6.63	6.27	

Measurements are based on the following assumptions:

- one sewer unit = 90 gallons/day = .00009 mgd (maximum daily flow)
- 3.2 sewer units per housing unit
- 1.1 sewer units per motel room
- 1.47 sewer units per 1000square feet of commercial floor space
- .9 sewer unit per campsite
- .07 sewer unit per 1000 square feet of casino floor space

These equivalencies are based on data obtained from the STPUD and DCSID facilities plans, direct correspondence with personnel from both districts, and original computations derived from observed values.

In 1978 the number of sewer units per residence in STPUD was 3.0. Under the five scenarios, the number of units per housing unit is estimated to increase 5 percent. The increase is based on the following assumptions:

- new housing will be single-family homes with more persons per unit than the present stock (which includes a mix of single-family and multiple-unit dwellings)
- nonresidents (with more persons per unit on a maximum day) will occupy a larger proportion of housing stock
- housing shortages will encourage higher occupancy rates.

Changes in the mix of types of housing are not expected to be so significant for DCSID.

The Park Tahoe Casino was not operating at full capacity during 1978.

Estimated plant capacities for STPUD under each scenario include 0.36 mgd which has been reserved for the U.S. Forest Service, the state of California, and Fallen Leaf Lake. The reserve includes:

400,000 gpd	total U.S. Forest Service contract
-160,000 gpd	amount of contract being used
240,000 gpd	U.S. Forest Service reserve
+ 60,000	state of California contract
+ 60,000	Fallen Leaf Lake
360,000 gpd	Total reserve

Residents of Fallen Leaf Lake are included in the baseline 1978 growth scenario although the plant capacity to eventually serve them is included in the required capacity estimates.

Estimates of required capacities (number of sewer units x 0.00009 mgd) are not absolute and may increase or decrease by as much as 5 percent. Possible variations in future conditions that cannot be precisely predicted are reflected by this range. Any significant changes in water conservation practices, methods of treatment and effluent disposal, and the number of persons per unit could effectively increase or reduce plant capacity. Furthermore, the capacities of treatment plant facilities could be increased as a result of policy decisions to reserve capacity in addition to that presently committed by contract.

Description

Any increase in growth as defined by the scenarios would necessitate plant modifications and/or expansion for both districts. In the STPUD area, the increase

in the number of residential units accounts for a sizeable part of the increase in sewer units. In the DCSID area, residential units again are a major contributor to total growth of sewer units, but the commercial sector shows the greatest percentage increase between 1978 and buildout. The peak wastewater flow for STPUD during the summer of 1978 was 5.8 mgd. As described earlier, the plant has been operating under a cease and desist order by Lahontan RWQCB, so that 5.8 mgd has been established as the baseline capacity for this EIS. A panel of engineers hired by STPUD determined in the fall of 1978 that the plant could be operated effectively at 7.0 mgd. Nevertheless, the capacity required by all scenarios except Scenario 1 is greater than 7.0. Without increases to plant capacity, residential and commercial development will be constrained.

A similar situation applies for DCSID, as required capacities under each scenario exceed the present baseline capacity of 2.3 mgd. Modifications to the existing treatment process would be necessary to accommodate the levels of growth anticipated under Scenarios 1 and 4. Plant expansion in conjunction with improvements would be necessary for Scenarios 2, 3, and 5.

Critical Implications

Modifications to the STPUD existing treatment process would be necessary to accommodate the levels of growth anticipated under Scenarios 1 and 4. Plant expansion in conjunction with improvements would be necessary for Scenarios 2, 3, and 5.

Expansion and process modifications to the DCSID treatment plant would be required under all scenarios. Additional disposal facilities beyond those specified by the current proposed plan would be required for Scenarios 3, 4, and 5. At present, a lawsuit is pending against DCSID to restrict the capacity of the treatment plant to 2.5 mgd. The Nevada Division of Environmental Protection has issued an effluent discharge permit that would limit the concentrations of BOD₅ and suspended solids to 15 mg/l on a 30-day average. The department maintains that effluent flows exceeding 2.5 mgd would result in violations of this permit. A consent decree regarding this issue is being negotiated; however, no settlements have been made. The litigation must be resolved before an effective course of action regarding plant modifications and expansion can be determined.

Question: What would be the cost to system users in the STPUD service area of implementing proposed plant modifications and expansion?

Measurements

	1	2	<u>Growth Scenarios</u>		5
			3	4	
Capital cost of wastewater facilities (\$ million)	8.9	21.5	18.9	8.9	21.5
Operation and maintenance cost of wastewater facilities (\$ million per year)	1.7	2.1	1.9	1.7	2.1
User charges (\$ per year) (individual residential users)	250	250	250	250	250

The estimated costs for Scenarios 1, 2, 4, and 5 were obtained from the facilities plan. Plant improvements required independent of capacity expansion are assumed to apply to Scenarios 1 and 4, and proposed capacity expansion with modifications presented in the facilities plan to apply to Scenarios 2 and 5. Estimated costs for Scenario 3 were calculated from data presented in the facilities plan and based upon discussions with district personnel.

Description

Alternative wastewater treatment and disposal facilities are needed because of the inability of the existing facility to consistently meet effluent requirements for Indian Creek Reservoir. The major effluent quality violations were for COD and ammonia concentrations. Secondary benefits from abandoning advanced treatment would be an annual savings of \$1.0 million in operational costs.

According to the facilities planning study, the most cost-effective alternative would involve a secondary treatment system and land disposal in Alpine County. The plan recommended construction of treatment facilities with a capacity of 10.0 mgd. The cost of modifying the existing treatment plant in a "head-start" program independent of any alternative and capacity increase would be \$8.9 million, and the capital cost of the complete plan (with a capacity of 10.0 mgd) would be \$21.5 million. Under the complete plan, reductions in operation and maintenance costs resulting from conversion to secondary treatment would more than compensate for local capital costs of the new facilities.

There is no significant difference in residential user charges for the five scenarios. The reason for the uniform charges is that while more capital expenditures will be required for Scenarios 2 and 5, the local cost of the facilities will be repaid by a larger number of users. Although the user charges may not be exactly equal for each scenario, the relative differences would be small.

Critical Implications

Construction of additional treatment capacity would be required for levels of growth projected under Scenario 2 through 5. The amount charged to users of the facility would be the same under all scenarios. Critical cost implications of providing water services are discussed along with the cost of providing other public services under "Public Services/Fiscal Concerns."

Question: What will be the cost to system users in the DCSID service area of implementing proposed plant modifications and expansion?

Measurements

	<u>Growth Scenarios</u>				
	1	2	3	4	5
Capital cost of wastewater facilities (\$ million)	21.9	21.9	24.5	26.5	26.5
Operation and maintenance cost of wastewater facilities (\$ million/year)	2.6	2.6	2.9	3.1	3.1
User charges (\$/year)	220	220	220	220	220

Costs for Scenarios 1 and 2 were obtained from the facilities plan. For Scenarios 3, 4, and 5, costs were calculated from data presented in the facilities plan. User charges were estimated from financial data in the facilities plan, but approximations were necessary due to the limited information presented. User charges are collected through ad valorem taxes, and data on that portion of the taxes collected currently allocated to wastewater facilities is not readily available. The facilities plan indicates that incremental annual charges for residential users will range from \$40 to \$125 depending upon specific location within the service area.

Description

The results of the facilities planning study indicated that the most cost-effective alternative would involve modifications to improve plant reliability and a land disposal system in Carson Valley, Nevada. The facilities plan specifies that no increase in the initial design capacity of 3.0 mgd will be involved with this project. However, proposed modifications will enable the plant to process up to 4.8 mgd on a maximum day basis. The relative distribution of total capital costs includes \$2.2 million for treatment plant improvements and \$19.7 million for the effluent disposal system.

There would be no significant difference in residential user charges for the five scenarios. The reason for the relatively stable charges is that although more capital expenditures will be required for higher development levels, the local cost of the facilities will be repaid by a larger number of users. In addition, because 72 percent of the total wastewater generated in the DCSID service area originates from hotels and casinos, unit cost would be lower for residential users. Although the user charges may not be exactly equal for each scenario, the relative differences would be small.

IMPACT ASSESSMENT

Question: To what extent will demand for energy sources be affected?

Measurements

	1978	1	2	Growth Scenarios		5
				3	4	
Electrical peak demand (MW):						
STPUD	62.3	71.0	95.9	85.8	71.4	98.3
DCSID	14.2	21.7	22.2	36.5	56.7	50.2
Total south shore	70.5	92.7	118.1	122.3	128.1	148.5
Net reliable capacity deficiency (MW)						
	30.5	36.7	62.1	66.3	72.1	92.5
Impact rating		Medium	High	High	High	Extreme
Demand for natural gas (mcf/d)						
STPUD	12,970	14,109	17,657	16,420	13,903	18,913
DCSID	2,681	3,436	3,694	6,109	7,494	7,114
Total south shore	15,651	17,545	21,351	22,529	21,397	26,027
Remaining capacity (mcf/d)						
STPUD	3,730	2,591	-957	280	2,797	-2,213
Impact rating		Medium	High	High	Medium	High
DCSID	619	-136	-394	-2,809	-4,194	-3,814
Impact rating		High	High	Extreme	Extreme	Extreme

Demand forecasts for electricity have been prepared by the Sierra Pacific Power Company (SPPC) for their master plan; however, this information was not available for inclusion in this report. A rough estimate of future peak demands was made based on peak demands for 1978 and population growth. Savings for conservation techniques or from energy-efficient appliances were not included in the estimate.

Net reliable capacity deficiency is the difference between the reliable capacity of the south shore electrical system (56,000 kw) and the demand for electricity.

It is difficult to assess the adequacy of the current natural gas system to meet existing and future demands, for several factors have affected consumption patterns. First, Southwest Gas Corporation has only recently been able to obtain assurance from its suppliers in Canada. Second, national policy on development and transmission of natural gas has caused uncertainty over the price. Third, the

availability of natural gas is determined by an agreement between CP National and Southwest Gas that requires CP National to contact Southwest Gas daily for its supply.

Projected natural gas demand for STPUD (service area is similar to the CP National service area) is based on peak summer permanent residents and commercial establishments. Projected demand for DCSID (service area is similar to the Southwest Gas south shore service area) is based on permanent residents only, as no information on commercial and industrial demand is available. Projections assume a per capita consumption rate equal to that of STPUD.

Remaining capacity for STPUD assumes a pipeline capacity of design-day conditions, at which time STPUD could receive a maximum of 16,700 mcfd. Remaining capacity for DCSID is based on design-day conditions and gas customers in STPUD receiving their maximum allocation. Thus, only 3,300 mcfd is left for DCSID gas customers, as total capacity into the south shore system is 20,000 mcfd.

Assessment of the systems' abilities to accommodate growth are made by comparing projected demand with the capacity of the systems. Ratings are described below:

- low: supply can reliably meet projected demands
- medium: supply can meet projected demands, but the demand is 75 to 90 percent of system capacity
- high: demand is within 90 percent of system capacity or is slightly greater than capacity
- extreme: demand exceeds system capacity by over 20 percent.

Description

Continued residential and commercial development will require expansion of the energy supply system. Although the electrical supply system has an installed capacity to accommodate low growth projected under Scenario 1, according to the reliability criterion developed by the utility companies, the present supply system is inadequate by 36.7 MW to meet this low level of growth. Under all other scenarios, demand would exceed reliable capacity.

Because the location of development is different for each of the scenarios, reliability of the system in various service areas would also differ. For example, Scenario 2 allows for rapid growth in the Stateline substation service area and minimal growth in Douglas County. Thus, the Stateline and Meyers substations would need to increase their capacities, whereas the Round Hill substation could continue to serve its population reliably without expansion. Under Scenario 4, system improvements would have to be concentrated in the Round Hill and Glenbrook service areas.

Natural gas supply is capable of meeting the demand for only a few more years. In 1974-1975, a harsh winter forced a temporary curtailment of service to CP National. Population has since increased, and another harsh winter is likely to have the same effect. Pressure on the CP National pipeline is already dangerously low, and unless a parallel pipeline is constructed, service may be halted.

Impacts on the natural gas system as measured above are understated, as the demand for commercial customers such as the casinos has not been included. The important comparison to make is that between the total south shore system demand and supply capacity (remaining capacity). Under all except the low growth scenario, average demand would be greater than capacity of the existing pipelines.

Considering demand from CP National gas customers alone, only population growth under Scenarios 1 and 4 can be reliably served. Uncertainties over the availability and price of natural gas have already caused some customers to switch to alternative fuel sources such as liquefied petroleum gas (LPG) and fuel oils for space heating.

Critical Implications

A rough comparison between electricity demand and supply indicates that demand will exceed existing supplies under all scenarios except Scenario 1. Several substations have non-coincident peak loads that already exceed or are close to the substation capacity. The Glenbrook substation is operating at capacity, and any failure on the Buckeye to Glenbrook transmission line would result in an electrical outage for all persons served in the area. Similarly, loads at the Stateline substation are already at 75 percent of capacity. Accordingly, development pressures, particularly those to build out existing subdivided lots in the city of South Lake Tahoe, will have serious implications for the provision of reliable energy supply.

A single transmission line supplies natural gas to the city of South Lake Tahoe, and a branch of this line goes north through Stateline. Any failure in this system (such as breakdown at the pressure limiting station) would cause natural gas shortages or outages. Those customers whose service would be interrupted first include STPUD, schools, hospitals, hotel-casinos, and other large commercial businesses. Because the basin service area is at the end of the supply system, pressures in the pipelines are barely adequate to provide reliable service. Demand for natural gas in STPUD and DCSID will exceed current design capacity under all scenarios except Scenario 1.

MITIGATION MEASURES

Water

1. Institute water conservation programs using financial mechanisms to reduce water consumption.

Description. Meters could be installed to measure water consumption. Unnecessary use could be discouraged by increasing water rates through an inverse rate structure or the present rate structure.

Effectiveness. Conversion from a flat rate charge to a metered charge could initially reduce indoor water usage by 30 percent. However, over time water use would tend to increase again toward its original levels. An alternative approach to reducing use would be to increase water rates in conjunction with universal metering. The incentive to adopt water-saving techniques could be strengthened by instituting an inverted rate structure, wherein each increment of water used would become more expensive.

Costs. High costs would be associated with a program to install meters on water services. STPUD has estimated it would cost \$3 million to install meters within the district. The impacts could be reduced by instituting a phased installation program over 10 to 15 years. An educational program on water conservation would be required to gain support from the general public.

Responsibility. Utility districts and water companies.

Timing. As soon as possible.

2. Install retrofit water conservation devices.

Description. Installing retrofit water conservation devices such as toilet dams, faucet aerator and flow restrictors, improved showerheads, insulated hot water lines, and improved-efficiency irrigation systems would reduce water use.

Effectiveness. These devices could reduce water use per household by 15 to 20 percent. However, based on other similar experiences, this reduction may be temporary, and water use could rise and approach original use in the long-run.

Costs. Unit cost per household for all devices would range from \$100 to \$350. Unit costs per household for toilet dams, faucet aerators and flow restrictors, and improved showerheads would range from \$25 to \$80 (using these three types of devices could reduce water use by 10 to 15 percent).

Responsibility. Homeowners.

Timing. As soon as possible.

3. Enforce mandatory water conservation efforts.

Description. Water conservation efforts would be required of all property owners. These efforts might include installation of any of the retrofit devices described above or the measures could be left to the discretion of the property owners as long as they achieve a specified reduction in water use.

Effectiveness. Mandatory water conservation could significantly reduce outdoor consumption. However, users would certainly object to this measure unless there was a shortage of water and drought conditions prevailed.

Responsibility. Utility districts.

Timing. As soon as possible.

Wastewater Treatment

Costs to Users

4. Make maximum use of available grants to reduce local costs.

Description. At present, grant funds are available for up to 87.5 percent of the capital cost of wastewater treatment facilities. For projects incorporating

innovative technology or extensive wastewater reclamation, grant funds may be provided for 97.5 percent of capital costs. All operation and maintenance costs are paid by local users.

Effectiveness. Subject to approval of request by SWRCB and EPA.

Responsibility. STPUD, DCSID.

Cost. See "Impact Assessment" above.

Timing. Coordinate with applications for grant funds.

Effluent Transport

5. Allow in-basin reuse of treated effluent.

Description. Use of reclaimed water within Lake Tahoe Basin is prohibited by state and federal requirements. The Porter-Cologne Act was amended in 1978 (California Water Code Sec. 13952) to permit pilot reclamation projects in the basin subject to approval of the Lahontan RWQCB. Applications must be submitted to the regional board by January 1, 1984, and must demonstrate that the proposed project will have a useful life of 10 years and will have no adverse impact on the basin. The RWQCB is empowered to place any conditions on project approval that it deems necessary to avoid adverse impacts. The facilities plan described in conjunction with the recommended plan a series of alternatives involving a 1.0 mgd demonstration project that would include advanced waste treatment followed by reverse osmosis to comply with the state "nondegradation policy."

Effectiveness. Subject to approval by SWRCB, reclaimed water could be used for irrigating golf courses and open space and for erosion control. In addition mitigating the effluent transport problem, the use of reclaimed water in-basin would prolong the useful life of available water supplies.

Responsibility. STPUD, DCSID.

Cost. It is assumed in-basin reuse would involve reverse osmosis, which is typically high in cost.

Timing. See "Description" above.

Energy

Physical Techniques: Electricity

6. Make needed improvements to the electrical supply system.

Physical Techniques: Natural Gas

7. Install 2300-foot, 8-inch pipeline parallel to existing pipeline that serves the California side of the south shore.

8. Construct a storage/peaking facility for liquefied natural gas (LNG).

Energy Conservation Techniques

9. Retrofit existing structures with additional insulation.
10. Revise building codes to require additional insulation of walls, floors, ceilings, attics.
11. Encourage energy audits.
12. Encourage development of energy-efficient transportation systems.

7. CULTURAL, ARCHAEOLOGICAL AND HISTORICAL RESOURCES

EXISTING CONDITIONS

The study areas have abundant archaeological and historical sites. The Tahoe-Carson Valley area was the nuclear territory of the Washo tribe. As nomadic hunters, fishers, and seed-gathers, they moved each spring from their winter villages in the Great Basin to establish base camps in the higher mountains and valleys. Their nomadic life came to an end in the late 1800s, when increased contact with the white man forced them to settle near towns and farms to work as laborers and traders. Washo archaeological sites are usually found along game trails, in seed-gathering areas, and along small tributaries to major streams.

Historical sites are reminders that the area was a major route during the westward movement in the second half of the 19th century. First trappers and explorers, then emigrants, prospectors, and miners passed through the basin. The area became a supply and transportation route, and small ranches, farms, and dairies developed around the wagon road stations to supply travelers. With logging and the industrialization of the Comstock Lode, these towns grew. The resort industry began to develop in the 1860s, and its growth accelerated in the 1930s when the California roads to the Lake Tahoe Basin were paved and again in the late 1950s when the casinos at Stateline were established.

Figures showing historical and archaeological sites in both study areas and an appendix identifying sites and sources of record are available for review at EPA, Region IX, San Francisco.

IMPACT ASSESSMENT

Question: How will the preservation of cultural resources be affected?

Measurements

	<u>Growth Scenarios</u>				
	1	2	3	4	5
Impacts on cultural resources in sensitive areas of					
City of South Lake Tahoe	Medium	High	High	Medium	High
Unincorporated parts of El Dorado County	Medium	High	High	Medium	High
Douglas County, DCSID service area	Medium	Medium	High	High	High
Upper Carson River Basin	Medium	Medium	Medium	High	High

Locations of proposed development were compared with known and potential sites of cultural resources. Flat areas with good sun exposure, protected from the wind, and adjacent to drainage systems or natural lakes and sloughs are considered potential sites of archaeological and historical resources.

However, actual impacts will not become apparent until a site analysis of proposed development is conducted. Consequently, the above impact ratings reflect only the potential for encountering cultural resources sites.

Description

The study areas (STPUD, DCSID, and Upper Carson River Basin) have abundant archaeological and historical sites, and further sites, particularly archaeological sites, are likely to be found. Thus, the potential is high for direct and indirect adverse impacts on cultural resources from land alteration associated with population growth.

Impacts may range from physical destruction of a site to slight disturbance such as occurs when a site is in an open space recreation area used by hikers, bicyclists, and picnickers.

Because the Tahoe area probably has many as yet undetected sites, developers may face increased development costs if the need to excavate or preserve a site arises. The actual costs would depend on the extent to which the development plan conflicts with the preservation of historical or archaeological sites.

Critical Implications

Impacts under scenarios that would lead to intensive development on new undeveloped terrain in the following areas are of particular concern:

- Lake Tahoe shore, particularly where creeks and rivers enter the lake (Madden Creek to Meeks Creek on the west shore; Truckee River and Truckee Marsh on the south shore; Edgewood Creek and Incline Creek on the east shore)
- Truckee River Valley from the city of South Lake Tahoe to the southern extension of the study area
- Fallen Leaf Lake and adjacent drainages
- Cascade Lake and adjacent drainages
- major and intermittent waterways and sloughs in Douglas County, particularly the branches and forks of the Carson River.

Question: What will be the direct effects of the proposed wastewater treatment facilities on archaeological and historical sites.

Description

The wastewater treatment facilities and pipelines in Alpine and El Dorado counties were surveyed by an archaeologist in May 1978 (Peak, A.S., and Associates, 1978a and 1978b). At that time, all proposed pipeline routes and reservoirs were inspected on foot and were given 100 percent coverage (except for a small parcel of pipeline). Two archaeological and three historical sites were recorded at that time. JS-SLT-1 is the site of a temporary camp and measures 20 x 30 meters. JS-SLT-1 is represented by several artifacts surrounding a spring. The area was so boggy that the significance of the site could not be determined. JS-SLT-2 is a garbage dump measuring 30 x 15 meters and is probably associated with JS-SLT-3, a foundation measuring 18 x 18 meters. JS-SLT-4 appears to be a recent (1930 to 1940) garbage dump.

No previously recorded cultural resources were identified within or adjacent to the project areas (Peak, 1978a). However, recent archival research at the California State Historic Preservation Office in Sacramento indicates that two archaeological sites, Alp-63 and Alp-15, are within a quarter of a mile of the proposed Gansberg Reservoir site and the Pocket Ranch Reservoir site, respectively, and that Alp-16 is within the boundaries of the proposed Pocket Ranch Reservoir site.

Both Alp-16 and Alp-15 are ethnographic pinyon-seed gathering sites. Alp-16 measures 200 x 100 feet and contains obsidian flakes and metal objects. Ta-sha-pau-di is its ethnographic name. Alp-15, called De-up-elik-ilaka, is characterized by mano fragments and obsidian flakes. Alp-63 measures 100 x 200 feet and is described as a temporary campsite, with obsidian and chert flakes and projectile points.

The 1977 archaeological survey failed to note the presence of Alp-15, Alp-16, and Alp-63; therefore, it is recommended that the proposed reservoir sites and pipeline routes be resurveyed. The part of the pipeline route omitted in the original survey should be surveyed at that time.

As Douglas County has not yet submitted the proposed locations for its wastewater treatment facilities and pipeline routes, no archaeological survey has been conducted for those locations. After the sites have been determined, they will have to be surveyed for cultural resources. When the rest of the proposed wastewater facilities locations have been submitted, a record search and survey for cultural resources can be conducted. At that time, all resources within the study area should be evaluated for National Register eligibility.

MITIGATION MEASURES

1. Require site analysis as part of the development or environmental impact review process.
2. Nominate cultural resources for inclusion in the National Register.
3. Require dedication of cultural resources by developer as part of subdivision process.
4. Purchase land or obtain restrictive easements to place sites in public possession.

F. **INDIRECT EFFECTS (SECONDARY IMPACTS): NATURAL RESOURCES AND ENVIRONMENTAL QUALITY IN UPPER CARSON RIVER HYDROGRAPHIC BASIN**

1. **GEOLOGY AND SOILS**

EXISTING CONDITIONS

The Carson Valley was formed by land uplifts and tiltings in two periods. In the first period, Cretaceous granitic rocks, which constitute the current bedrock, were formed. In the second period, faulting, scarping, and tilting took place. To the west, the Carson Range of the Sierra Nevada was formed as a 4,000-foot degraded fault scarp. To the east, the Pine Nut Mountain "blocks" were uplifted on their eastern flanks and tilted westward. Stream deposits and outwash from the Carson Range and Pine Nut Mountains steadily filled the low area and created the valley floor. The average depth of the deposits is 1,200 feet. The lowest section is on the west side of the valley, even though depth to bedrock granitics is deepest there (3,600 feet).

The Carson Valley is the northeastern edge of the Western Nevada-Eastern California seismic zone, a region described as especially active. The major fault danger in the zone is from a north-south fault, which runs along the base of the Carson Range near Genoa. Its scarp has a maximum displacement of 44 feet, and the fault is considered capable of producing a severe earthquake of magnitude 8 to 8.5. The blocks of the Pine Nut Mountains are bounded on the east by north-trending faults. This fault area and the Carson Range area produce hot springs, which indicate possible volcanic activity. On the high eastern side of the Carson Valley, faults with maximum 20-foot displacements slice through the older alluvium. The combination of down-thrown faults on the east side and faults dipping west creates a "horst and graben" structure in the area. Figure 15 shows faults in the study area.

The mountain ranges and the alluvial valley floor of the Carson Valley are made up of a number of soil types. On the valley floor, soils are underlain by high water tables and recent alluvial materials. Many valley soils are suitable for several crops and have few agricultural limitations. However, at higher elevations on the east side of the valley, soils are underlain by low water tables and older alluvial materials and are limited for agriculture by slope, drainage, soil depth, and chemistry.

Carson Valley was surveyed in 1977 to determine which soils were suitable for irrigation with reclaimed wastewater. Some valley soils cannot be used for this purpose because of poor drainage, frequent or serious flooding, excessive slope, high water tables, and high surface concentrations of salts or alkali. Areas with suitable soils are shown on Figure 16. The most promising area for irrigation with reclaimed wastewater is the Dangberg Ranch site, which covers 28 square miles. Soils on the alluvial fans and terraces of the Pine Nut Mountains are deep and well drained, but are generally unsuitable for cultivation and are limited to native or seeded dry-pasture grazing; soils north, northwest, and south of Buckeye Creek are suitable for cultivation of alfalfa in rotation with small grains if attentively managed and irrigated with sprinklers or in furrows.

An 8-square-mile site in the Pine Nut foothills under jurisdiction of the Bureau of Land Management has soil types similar to those on the Dangberg Ranch and is probably suitable for permanent pasture and livestock grazing. It is the second most promising area for future agricultural development if reclaimed water is imported to the valley on a large scale.

Southeast of the Dangberg Ranch and east of Dresslerville is the third most desirable site for irrigation with reclaimed wastewater. The western third of the area is irrigated and suitable for alfalfa grown in rotation with small grains. However, most of the area is uncultivated and suitable only for the grazing of native grasses, which must be augmented with seed.

The soils in Jacks Valley and east of the valley along both sides of U.S. 395 are least acceptable for irrigation with reclaimed wastewater. Small acreages of soils scattered throughout the area are suitable for alfalfa and small grains. However, most soils are suitable only for permanent pasture.

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Figure 15 **GEOLOGIC UNITS
HAZARDS & FLOODING
UPPER CARSON RIVER BASIN**

U
..... APPROXIMATE 100 YEAR FLOOD PLAIN
..... SEISMIC FAULTS

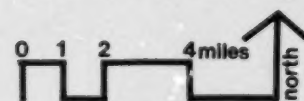
GEOLOGIC UNITS:

XXXXXX	RECENT FLOOD PLAIN ALLUVIUM
	TRIBUTARY STREAM DEPOSITS
////	ALLUVIAL FAN DEPOSITS
////	OLDER ALLUVIUM
=====	UNDIFFERENTIATED SEDIMENTS
=====	UNDIFFERENTIATED ANDESITICS VOLCANICS
=====	GRANITIC INTRUSIVES
=====	UNDIFFERENTIATED METASEDIMENTS
+++++	UNDIFFERENTIATED METAVOLCANICS

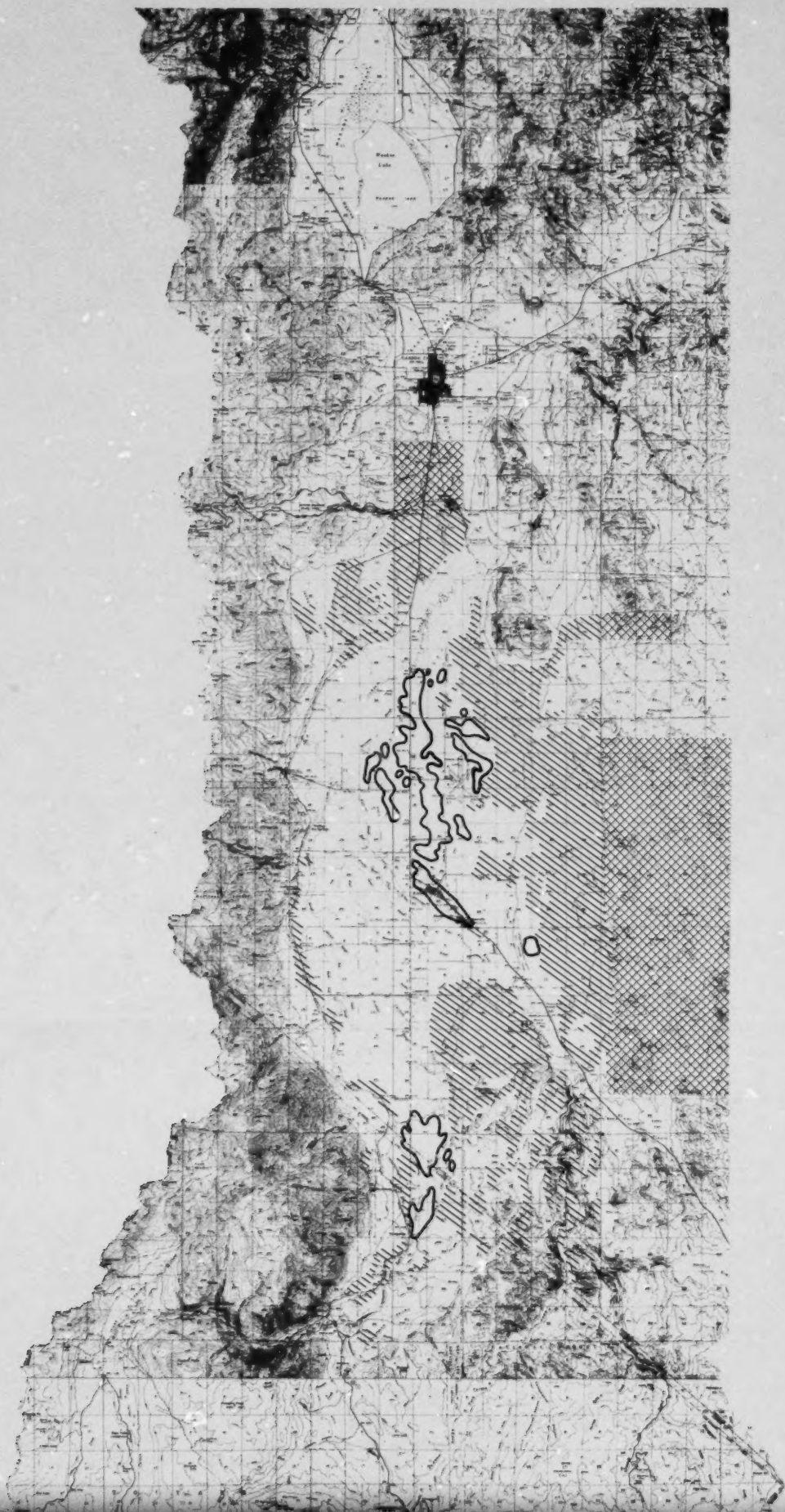
Tahoe Region Environmental Evaluation Study

U.S. Environmental Protection Agency
Sedway/Cooke

B



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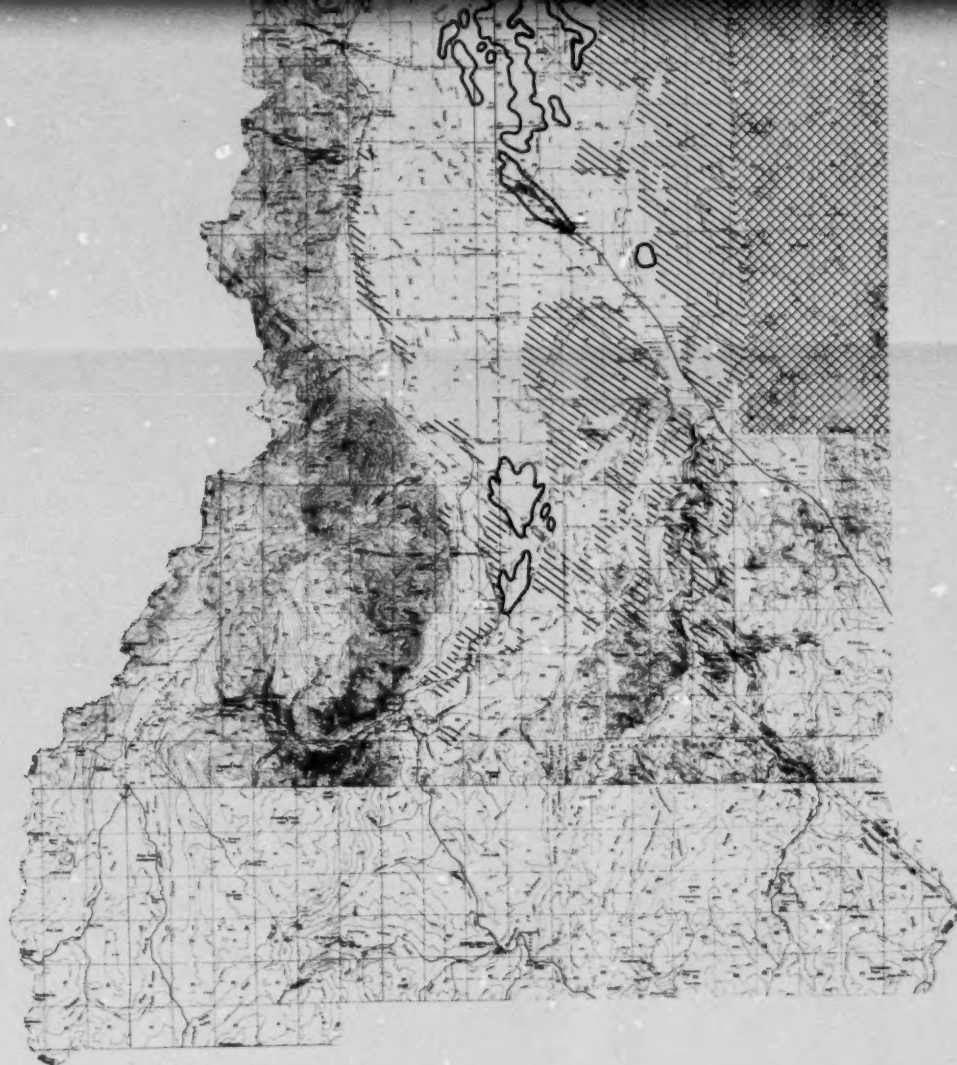
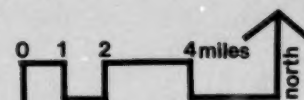


**Figure 16 SOIL SUITABILITY FOR
WASTEWATER IRRIGATION
UPPER CARSON RIVER BASIN**

-  **MOST SUITABLE**
-  **POTENTIALLY SUITABLE**
-  **MODERATELY SUITABLE**

Tahoe Region Environmental Evaluation Study

**U.S. Environmental Protection Agency
Sedway/Cooke**



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IMPACT ASSESSMENT AND MITIGATION MEASURES

For geologic impacts for the Upper Carson River Basin and for approaches to mitigate adverse impacts, refer to Lake Tahoe Basin "Geology and Soils."

2. BIOLOGY

EXISTING CONDITIONS

Vegetation

Five distinct, natural vegetational communities occur within the study area: conifer forest, sagebrush steppe, pinyon-juniper woodland, streamside vegetation, and aquatic and marsh communities. Montane coniferous forest occupies the western slopes of the basin at elevations ranging from 5,000 feet (less than 500 feet above the valley floor) to 9,000 to 9,500 feet along the ridgeline of the Carson Range. At the lower elevations, the forest is dry and open, with Jeffrey pine dominating a sagebrush or chaparral understory. Around 6,000 feet, other conifers, including white fir, incense cedar, and western juniper, become more prominent.

The lower slopes of the mountains on both sides of the valley and, in undisturbed areas, the valley floor are covered with a treeless shrub community, dominated by sagebrush. Bitterbrush, Chrysothamnus nauseosus, and Happlopappus are important associates, and balsamroot, Mormon tea, desert peach, and a variety of herbaceous plants and grasses are also common. Although sagebrush steppe does occur within the Lake Tahoe Basin, it is only on the Great Basin side that sagebrush becomes a prominent feature of the landscape. On the valley floor, many acres of former sagebrush have been cleared, irrigated, and cultivated as pasture or forage cropland. Seral succession within the sagebrush steppe varies with the type of disturbance (Young *et al.*, 1977). For example, fire or disruption of the soil surface increases the proportion of root-sprouting plants, including Chrysothamnus, desert peach, and Purshia. The latter is a most valuable browse species for domestic and native herbivores. Artemesia dominance is reduced. In contrast, exclusion of fire or severe overgrazing by domestic or native animals encourage the spread of Artemesia, reducing the amount of favored browse.

Conifer forest is typical of Sierran slopes, but pinyon and juniper woodland characterizes the mountains and bajadas of the Great Basin. Pinyon pine and Utah juniper are the dominant species, with Jeffrey pine occurring at higher elevations. Understory in the pinyon and juniper woodland is a sagebrush steppe association. The Pine Nut Mountains on the eastern edge of the study area are covered with this pinyon pine-Utah juniper association, from which their name was derived. At the southern end of the valley, where the headwaters of the Carson River lie in the Sierras, pinyon pine extends as far west as Hope Valley (Smith, 1973), but Utah juniper reaches its western limit just over the line into Alpine County, California, in the Pinyon-Juniper Natural Area (NA 020150) (Hood, 1978; Young *et al.*, 1977). Jeffrey pine, which grows in association with pinyon pine and Utah juniper at higher elevations in the Nevada hills, replaces Utah juniper in the Carson headwaters area.

A second plant of interest to the Nevada Native Plant Society is Lupinus malacophyllus. A member of the pea family, this plant is endemic to the Carson City-Reno area (Penzl, pers. comm.). Although of scientific interest, Lupinus malacophyllus has no official status as a rare, threatened, or endangered plant.

Happopappus eximius, an alpine composite, is narrowly endemic to the Sierra Nevada. In California it is found only on peaks in El Dorado County (Smith, 1973; Munz and Keck, 1968). It grows several places in the Tahoe basin and also along the West Fork of the Carson River just west of Woodfords. This plant has no official federal status and is considered rare but not endangered by the California Native Plant Society (Powell, 1974).

Locations of rare and endangered species are shown in Figure 17.

Unique and Sensitive Areas. The California Natural Areas Coordinating Council has described two areas of interest in the Upper Carson River Basin (Hood, 1978). The Hope Valley area, just east of the Sierra crest, is a large, relatively undisturbed mountain meadow of scenic and scientific value. On the West Fork of the Carson River is the steep-sided Carson River Canyon. This canyon is an important deer migratory route and is of botanical interest as well (Hood, 1978).

Natural areas are shown in Figure 17.

Wildlife

The Upper Carson River Basin contains some of the most diverse and valuable wildlife habitat in the state of Nevada. Snowpack on the Sierran slopes of the Upper Carson River watershed in California releases meltwater throughout the dry season, providing the Nevada portion of the basin with an amount of water unequalled elsewhere in the state (Miller, pers. comm.). Habitat types represented in the study area range from the dry, upper Sonoran sagebrush steppe and pinyon pine-juniper woodlands characteristic of the Great Basin biogeographic province to the montane conifer forests of the Sierra Nevada.

Compared with the neighboring Lake Tahoe Basin, human intrusion into the Upper Carson River Basin has been moderate. The primary disturbances to regional habitat have been from agricultural and grazing. Urbanization at present is concentrated in the Carson City area, but suburban sprawl and town center expansion are occurring to the south of the city, especially near Stewart, and in the Minden-Gardnerville area in the southern half of the basin.

The Sierran montane forest of the Carson Range includes large areas of the Toiyabe National Forest and is adjacent to protected state and federal lands across the ridgeline on the Tahoe side. Its seeps, springs, wet meadows, and aspen groves are of critical importance to furbearers, hawks, and many other wildlife species.

Water is a limiting factor for wildlife in the arid lands east of the Sierra Nevada, and freshwater marshes, riparian vegetation, and springs and seeps along the Carson Valley are critical habitat for many species of wildlife, including resident and migratory waterfowl. Canada geese which migrate from Alberta to the lower Central Valley in California depend on the Carson Valley as a resting area.

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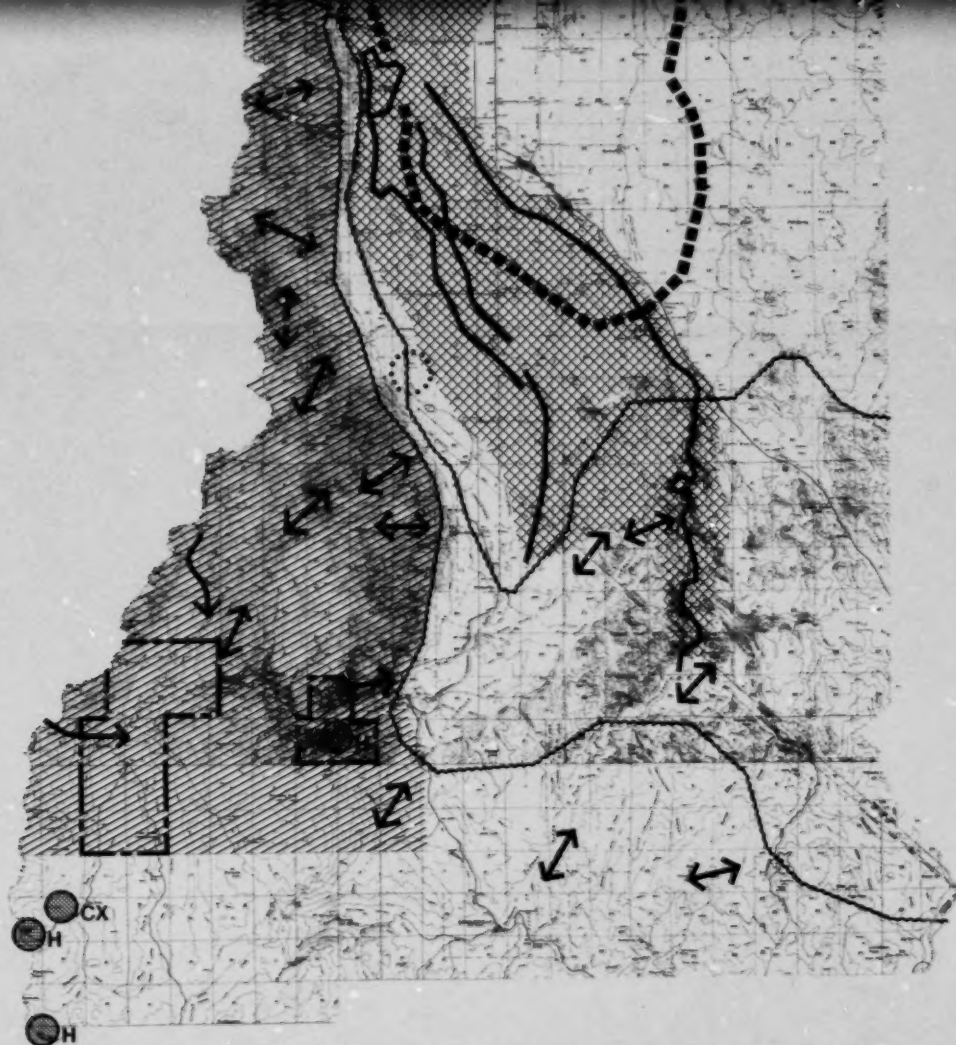


**Figure 17 AREAS OF PRIMARY BIOLOGICAL SIGNIFICANCE
UPPER CARSON RIVER BASIN**

AREAS OF PRIMARY BIOLOGICAL SIGNIFICANCE (NO DEVELOPMENT)

- ~~~~~ DEER WINTERING AREA
- ↔ MAIN DEER MIGRATION CORRIDORS
- RECENT PLANT COLLECTION - PRECISE LOCATION KNOWN
- C CAMISSONIA NEVADENSIS
- L LUPINUS MALACOPHYLLUS

- H HAPLOPAPPUS EXIMIUS
- CX CAREX WHITNEYI
- CALIFORNIA NATURAL AREA
- CRITICAL BUTTERFLY HABITAT (SPEYERIA NOKOMIS APACHEANA)

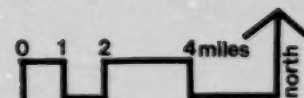
AREAS OF PRIMARY BIOLOGICAL SIGNIFICANCE (LIMITED DEVEL.)

- IMPORTANT FISHERIES - DESIGNATED BY NEVADA FISH & GAME
- ▨ WINTERING AREA, BALD & GOLDEN EAGLES
- CRITICAL NESTING AREA - SWAINSON'S HAWK

- ▨ WILDLIFE AREA - CRITICAL ABOVE 7000' ELEV. FOR FURBEARERS
- AREA SUBJECT TO ENVIRONMENTAL REVIEW

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B

Arid habitats are generally more easily disturbed and take longer to recover than wetter areas. Introduced annuals interrupt and prolong successional reversion of disturbed soil areas to sagebrush steppe, reducing the amount of valued native forage plants such as bitterbrush (Purshia tridentata) and perennial grasses (Young et al., 1977).

Sagebrush steppe and pinyon-juniper are important habitat to regional wildlife populations, particularly mule deer and the small prey species like the jackrabbit, which constitute an important food source for hawks, eagles, and other large predators.

Rare, Threatened or Endangered Species. The southern bald eagle (Haliaeetus leucocephalus) is listed by the U.S. Fish and Wildlife Service (40 FR 44417, September 26, 1975) as an endangered species. Bald eagles are regular winter visitors to the Carson Valley. Here they find adequate food and suitable hunting and roosting habitat to sustain them through the season. Bald eagle inventories are conducted annually by the Nevada Department of Fish and Game. In 1978 the 8 birds sighted in the Carson Valley and along the Carson River during a single aerial survey constituted 30 percent of the statewide total of 27 birds. In 1977 and 1976, the figures were 3 out of a total of 53 (6 percent) and 14 out of a total of 40 (35 percent), respectively (Herron, pers. comm.). Riparian growth, lakes, impoundments, and marshes of the area, with their associated waterfowl and fishes, are critical wintering habitat for the eagles (Herron, pers. comm.). The eagles range along suitable habitat within the basin, but apparently favor certain locations such as Mud Lake. Eagles are known to use the Dangberg Reservoir area occasionally (Christensen and Herron, pers. comm.).

A steadily decreasing rate of reproduction has endangered the southern bald eagle. A combination of factors contribute to this population decline. The reduction of suitable breeding habitat near water is partly responsible. The contamination of food chain by residues of organochloride pesticide causes eggshell thinning and nesting failure. Human interference has an adverse effect on eagles and other raptorial birds, although the response of eagles seems to vary with local conditions, time of year, phase of breeding cycle, and other factors (Snow, 1973). Most raptorial birds are especially sensitive to intrusion during the breeding season, especially during egg laying and incubation and just following hatching.

One species of fritillary (Speyeria apacheana) has recently been proposed for listing as an endangered species (Harjes, 1978). This butterfly inhabits arid regions, where it finds suitable habitat in moist or wet areas (Orsak, pers. comm.). Colonies of S. apacheana are known to occur in the Carson Valley along the foothills of the Carson Range (Harjes, pers. comm.).

Like all fritillaries, larval apacheana feed on species of Viola, the violet. Although no collections have been made, the apacheana in Carson Valley probably feed on V. nephrophyllia, the kidney-leaved violet (Penzl, pers. comm.).

Reductions of water table or changes in drainage patterns adversely affect S. apacheana. Once common in the Owens Valley, known populations of apacheana in that area are now extinct. The construction of the Los Angeles aqueduct around 1902 led to an overall lowering of the water table in this formerly moist region and eliminated suitable habitat for the butterfly (Orsak, pers. comm.).

Rare and endangered species are shown in Figure 17.

Fish

The streams and associated fish fauna of the Upper Carson River Basin are part of the Lahontan system (Moyle, 1976). Fish found there include native species, introduced species that have become naturalized, and nonbreeding fish that are planted annually in suitable habitats. The basin fishery compares favorably with other areas of Nevada. Productive angling streams of the Upper Carson River Basin are indicated in Figure 17.

Sensitivity Ranking

The Upper Carson River Basin contains over 750 square miles of diverse biotic components and includes wild, remote areas that contrast with farmlands and emerging urban centers. Compared with the Lake Tahoe Basin, human intrusion into the valley has been moderate, and many biological resources have been preserved, although somewhat diminished. Areas of primary biological significance include deer wintering areas and migratory corridors, California natural areas, a Nevada State Wildlife area, and locations of rare or otherwise important species. These areas cannot support development without some damage. Also considered of primary significance are critical nesting areas for Swainson's hawk, wintering areas for bald eagles and gold eagles, and wildlife areas in the Carson Range (including areas above 7,000 feet in elevation) that are critical habitat for furbearers. These areas include large areas and could accommodate limited development such as recreational use or low-density residential development with suitable environmental controls. Areas of moderate biological significance include all other undeveloped areas, managed and unmanaged rangelands, and cultivated areas within the basin. These areas could accommodate development, subject to environmental review.

Urban areas are of minor biological significance.

IMPACT ASSESSMENT

Question: How will valuable biological resources in the Upper Carson River Basin be affected?

Measurements

	1	2	Growth Scenarios		5
			3	4	
Native plant associations (sagebrush steppe; pinyon-juniper)	Low	Low	Low	Low	Low
Wildlife habitat on Carson Range	Low	Low	Low	Low	Medium
Rare and endangered plants	Low	Low	Low	Low	Low
Hawk nesting areas	Low	Low	Medium	Medium	Medium
Bald and golden eagle wintering areas	Low	Low	Low	Medium	Medium
Freshwater habitat of valley and upper basin	Low	Low	Low	Low	Low
Habitat of butterfly (<i>Speyeria nakomis apacheana</i>)	Low	Low	Low	Low	Medium

Spillover development from the Lake Tahoe Basin is assumed to be low-cost, single-family housing which would generally occur in and around Minden-Gardnerville. New development is also expected (1- to 2-acre parcels) along Foothill Road. Single-family residential development would intensify along the foothills of the Carson Range, but the eastern side of the valley would not be affected by spillover development from the Lake Tahoe Basin. Public lands within Toiyabe National Forest would be protected from development, and intensive development of private lands within these boundaries would be discouraged. Development of floodplain and agricultural lands is assumed to be compatible with the Douglas County General Plan (one unit for every 10 or 20 acres). This type of development would be little affected by the spillover demand for low- or moderate-cost housing.

Recreational use is expected to increase, but not as intensely as in western areas of the Lake Tahoe Basin.

Description

Removal of riparian vegetation, disturbance of ground cover adjacent to streams, channelization and diversion, and destruction of marshes significantly reduce the quality of the riparian habitat. Degradation of water quality adversely affects

resident and stocked fish populations, the primary food source for the wintering bald eagles. Roosting habitat for eagles and nesting habitat for hawks would be reduced by removal of cottonwoods and other riparian trees, and suburbanization of surrounding open lands would reduce the habitat for prey species: small mammals, amphibians, and insects. Increased human activity may unduly disturb the eagles and hawks, particularly when adult hawks are sitting on eggs or tending nestlings.

Critical wet habitats would be further altered by increased recreational use on public lands and scattered residential or vacation home development, which could fill, redirect, and deposit sediment. Overdraft or mismanagement of the available water resources could destroy or diminish the available Speyeria apacheana habitat.

Additionally, habitat for native wildlife has been reduced by irrigation, cultivation, and grazing of many acres of sagebrush steppe in the Carson Valley. Loss of habitat and associated increased disturbance from urban encroachment on the winter range has been the primary cause of population decline of the Carson Interstate deer herd population, as well as the Verdi herd of the north Tahoe area. Residential development and highway construction have also seriously interfered with deer movements along migratory corridors and within the valley, particularly at the northern end. With increased development, these trends would continue.

General sensitivities and consequences of residential and recreational development on rare and endangered plants are presented under the heading in the Lake Tahoe Basin section. In the Carson River Basin, modification of the lupine and Camissonia habitat by expanding residential development on alluvial lands near Carson City could be severe.

Critical Implications

See "Description" above.

MITIGATION MEASURES

- I. Establish and implement controls on nonpoint source water pollution.

Description. Controls on activities (land use grading, construction site coverage) SEZs and high erosion hazard lands would help protect streamside and other freshwater habitats from effects of agriculture runoff, erosion, urban runoff, and turbidity.

Effectiveness. Would depend on established standards and success of implementation.

Responsibility. Douglas County and Carson City planning departments; Carson River Basin COG.

Cost. Would depend primarily on implementation.

Timing. As soon as possible.

2. Protect plants and their critical habitats.

Description. Plant habitats may be protected by controlling recreational use on public lands, where appropriate, and through purchase, easements, or other methods of control on private lands.

Agricultural practices that leave strips of native vegetation should be encouraged. These strips should be connected to larger, undisturbed plots of similar habitat whenever possible to facilitate animal movements. Where residential development occurs in sagebrush or pinyon-juniper, clearing of natural vegetation should be minimized, and landscaping with native plants should be encouraged to conserve water and preserve some wildlife habitat value.

Effectiveness. Highly to moderately effective. Would depend on education and voluntary cooperation of landowners and developers.

Responsibility. Fish and Wildlife Service, U.S. Forest Service, Bureau of Land Management.

Cost. Would depend on land involved and arrangements made. May partly be borne by developers and landowners.

Timing. As soon as possible, before development increases.

3. Protect eagle and hawk nesting populations.

Description. Eagle and hawk nesting populations should be monitored and data thus gathered used as a basis for detecting deleterious changes in habitat or population status and for identifying threats. Valuable habitats should be delineated, and management recommendations made. Critical habitat components identified in the inventory--nesting trees, both active and potential, or productive prey habitat--should be protected by zoning, tree removal ordinances, or other land use controls. Active nestings should be protected from disturbance by prohibiting or discouraging clearing, construction, or other intensive activity within 1/8 mile (660 feet) of any nest tree during nesting season. All new power lines should be of a design that prevents accidental electrocution. If necessary, easements, acquisition, purchase of development rights, or other approaches should be used to secure valuable habitat.

Effectiveness. Would depend on the detail of the monitoring program and the success in implementing recommendations.

Responsibility. Nevada Department of Fish and Game, Fish and Wildlife Service (through Endangered Species Act of 1973), Public Works Department, Bureau of Land Management, Douglas County and Carson planning departments.

Cost. Would depend on the detail and design of the program.

Timing. As soon as possible; should continue as a yearly or seasonal program.

4. Consider regional pattern of development in evaluating impacts of individual projects to protect habitat.

Description. Incremental and piecemeal development that fragments the habitat into smaller patches should be avoided. If necessary, easements, conservation zones, lease-back arrangements, or fee acquisition should be used to secure and protect critical habitat and buffer zones. A master inventory of the resource and more detailed assessment of development proposals should be undertaken as a basis for regional impact evaluation.

Effectiveness. Essential in preserving the eagle and hawk habitat; effectiveness would depend on the authority and intent of responsible land use control agencies.

Responsibility. Fish and Wildlife Service, Douglas County and Carson City planning departments, Bureau of Land Management, Nevada Department of Fish and Game.

Cost. Would depend on design of the inventory and efficiency of proposal review process.

Timing. Undetermined.

5. Protect deer herds and habitat.

Description. Deer herd movements and range conditions should be monitored and measures taken for their protection (see measures 3 and 4 above). Jacks Valley (and other key deer areas, as necessary) should be closed to recreational use, particularly off-road vehicles, when deer are on their winter range.

Effectiveness. Partly effective; encroaching residential development places stress on wintering deer that will not be reduced by this mitigation.

Responsibility. Bureau of Land Management.

Cost. Estimation of cost requires data on current recreational use and other factors.

Timing. Yearly, during time deer are on winter range.

6. Protect Seyeria apacheana and its habitat.

Description. A baseline study to provide data on population size, characteristics, and habitat condition of Seyeria apacheana should be conducted to identify critical habitat and potential threats. Using this information, management recommendations can be made that might include prohibition or control of agricultural uses or development. If necessary, lands should be acquired by outright purchase, easement, less-than-fee acquisition, lease, or other arrangements.

Effectiveness. Would depend on completeness of recommendation and success of implementation.

Responsibility. Douglas County Planning Department, Nevada Department of Fish and Game, Nevada State Museum.

Cost. Would depend on acquisitions, other management recommendations.

Timing. As soon as possible; would require at least one breeding season to collect data.

3. WATER RESOURCES AND WATER QUALITY

EXISTING CONDITIONS

Water Resources

The major water resource in the Upper Carson River Basin, the Carson River, originates in the eastern slopes of the Sierra Nevada. Most of the watershed lies in Alpine County, California. The two forks of the Carson River emerge from adjacent subwatersheds (the West Fork watershed to the north) and flow east along Indian Creek into the Carson Valley. The two forks meander through the valley floor in a network of ditches and sloughs before finally comingling east of Genoa to form the mainstream of the Carson River. The Upper Carson River Basin and the locations of major water resources are shown in Figure 18.

Most surface water flowing through the Carson Valley originates in the California watersheds and the Carson Range. Precipitation in the valley and Pine Nut Mountains, while not insignificant, is either lost to evaporation or serves to recharge groundwater reserves. Most precipitation (about 81 percent of the total) falls in the form of snow from Pacific Ocean weather fronts moving east across the Sierra Nevada. Weather fronts from the Great Basin drop 11 percent of the total precipitation (mostly in late spring and late fall), and weather fronts from the Gulf of California contribute 8 percent in the form of summer thunder showers.

Flows in the Carson River fluctuate according to the season. Flows in the West Fork can range from nearly zero in late summer to almost 400 cubic feet per second during spring runoff. Flows in the East Fork range from below 100 cubic feet per second to above 1,200 cubic feet per second in May. The net outflow of the Carson River can fall below the flows of its two forks from March to November when its flow can drop to less than 80 cubic feet per second. During high water months, the same reach of stream can flow at 1,500 cubic feet per second. Figure 19 shows the yearly water budget of the Carson River.

Water stored in the watershed amounts to 6,500 acre-feet. This does not include the 3,100 acre-feet capacity of Indian Creek Reservoir, which stores reclaimed water from the south Lake Tahoe area. Mud Lake Reservoir is the largest reservoir in the Carson Valley, with a capacity of 4,700 acre-feet. Below these small structures, the river flows unrestricted (except by agricultural diversion dams) through the Carson Valley.

The available groundwater supply is estimated to be 32,000 acre-feet per year. This estimate is based on an annual groundwater recharge of 25,000 acre-feet from

precipitation and a subsurface inflow to the groundwater basin of 7,000 acre-feet per year.

Heavy winter rains and snows have, in the past, caused river flows higher than the Carson River long-term average. Floodwaters come mainly from the California watersheds, augmented by runoff from the Carson Range. Heavy winter rain and snow floods (wet mantle or rain on snow) have occurred only once in the Pine Nut Mountains in recent times.

Because of the lack of upstream reservoirs and the geography of the area, the Carson Valley is a natural floodwater receptacle. During the period of recorded observation, there have been at least 18 major floods in the valley. Of these, 10 were wet-mantle (heavy winter rains); 7 were the result of the rain falling on snow; and one was caused by snowmelt after a heavy winter. The flood on December 23-24, 1955, was one of the largest floods of record. A flood of this magnitude has a recurrence interval of once in 83 years. Until upstream flood protection is provided (by the proposed Washoe Project Dam on the East Fork), winter flooding will continue. Flood frequency data have been prepared from historical records. Table 36 shows flood discharges that can be expected to recur at 10, 25, 50, and 100-year intervals. Five of the largest floods in the Carson Valley and the recurrence interval of these floods along each reach of the river are also reported.

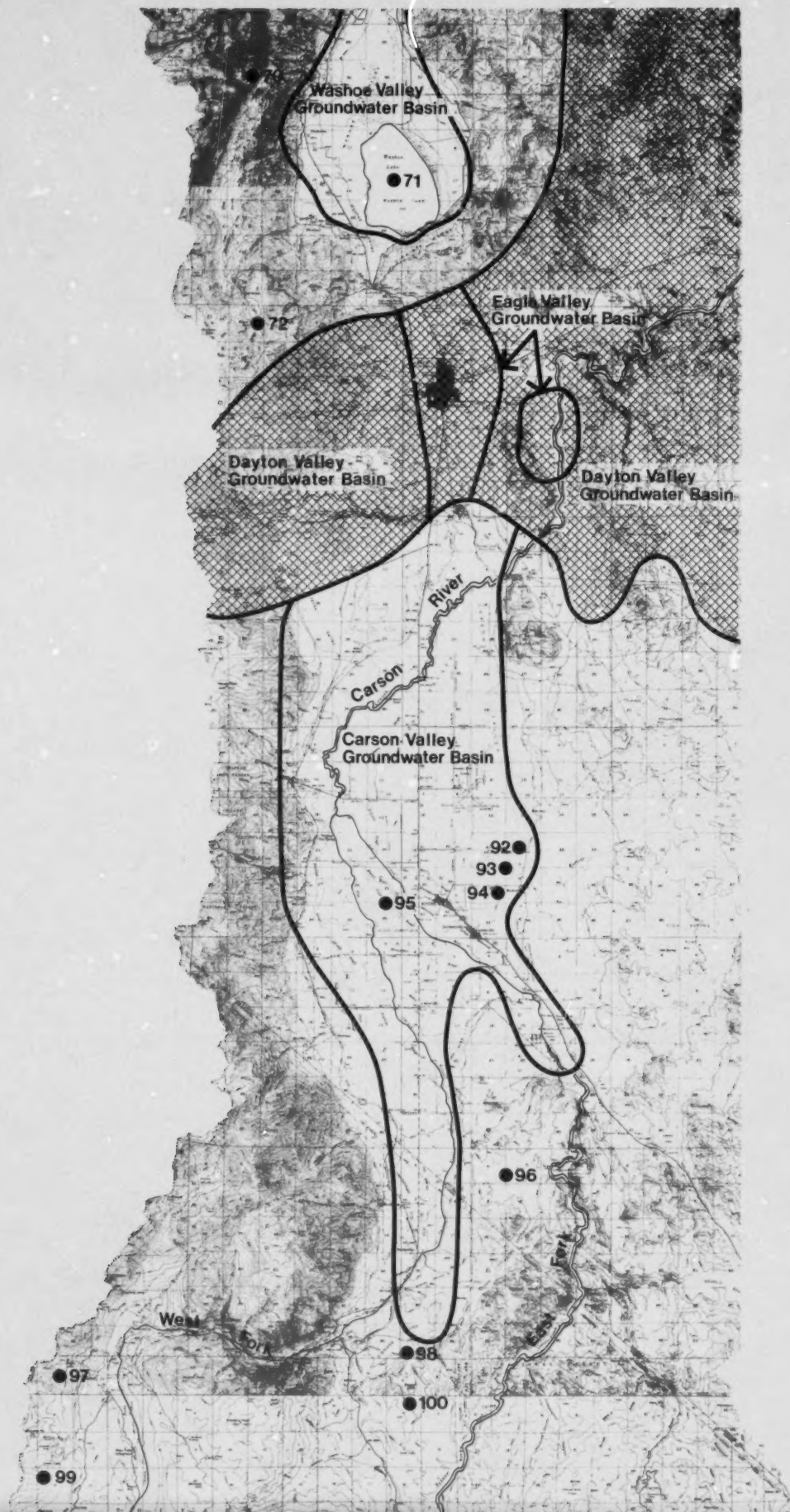
The valley also has a history of flash floods during the summer months. Flash floods have occurred along the short streams flowing from the Sierra Nevada and the Pine Nut Mountains. Flash floods have not caused extensive monetary damage because affected lands are usually undeveloped. However, damage levels of future floods, winter and summer, are expected to rise because of development in the Carson Valley.

Water Quality

Water Quality Standards. The surface and subsurface waters of the Upper Carson River Basin are generally of excellent quality. Because of the high quality, the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Board (RWQCB) in California, the Nevada State Bureau of Environmental Health, and various other state agencies have identified a number of beneficial uses. Such uses include those for municipal and domestic supply, agricultural supply, groundwater recharge, freshwater replenishments, water-contact recreation, non-water-contact recreation, cold freshwater habitat, wildlife habitat, preservation of rare and endangered species, hydropower generation, and industrial service supply.

Beneficial uses for each water body in the California portion of the basin are shown in Table 37. In the Upper Carson River Basin, which includes parts of California and Nevada, each state is responsible for developing and enforcing its own standards, which must be at least as stringent as the minimum standards set by EPA. Section 13241, Division 7, of the California Water Code stipulates that each RWQCB shall establish water quality objectives to protect beneficial uses and to prevent nuisance. Water quality objectives for the study area are enumerated in the Water Quality Control Plan Report for the North Lahontan Basin. In Nevada, the Bureau of Environmental Health has established surface water quality standards

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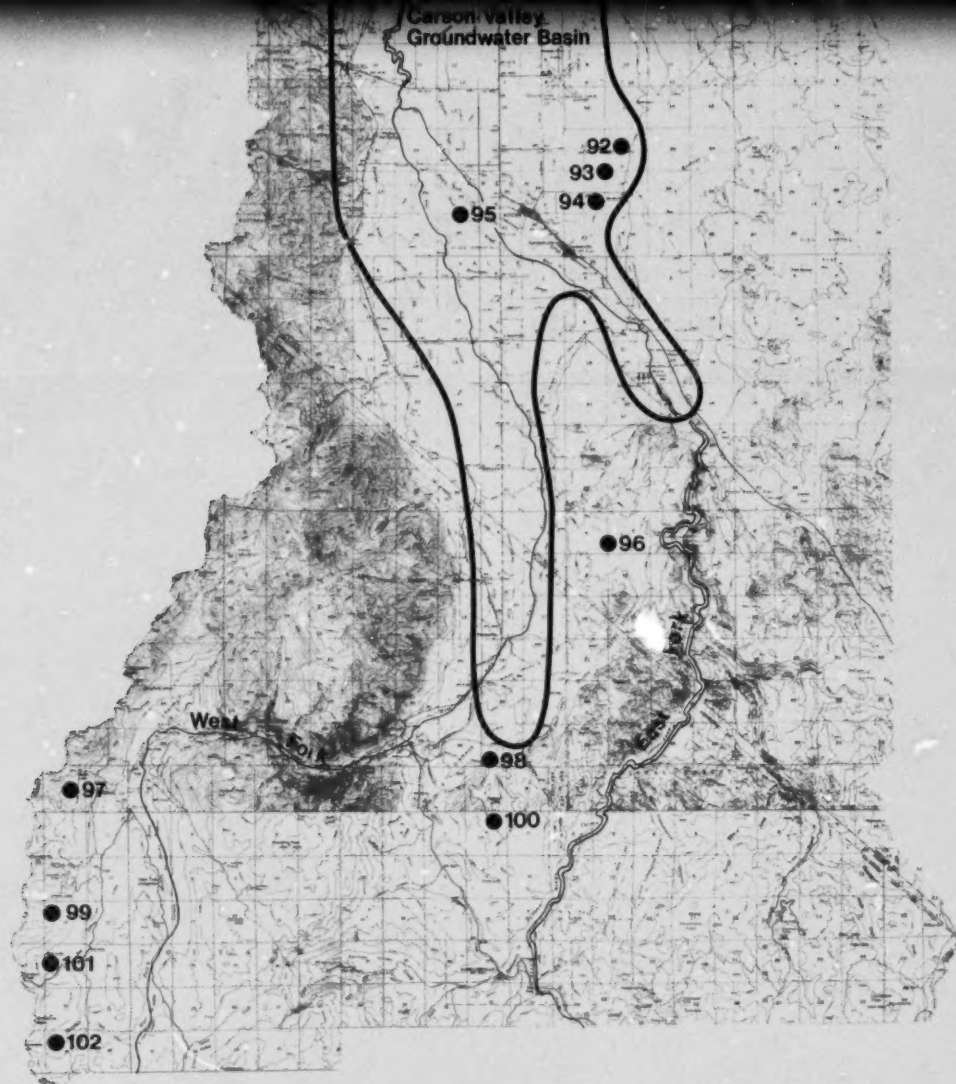


**Figure 18 WATER RESOURCES
UPPER CARSON RIVER BASIN**



GROUNDWATER BASINS

CRITICAL GROUNDWATER BASINS

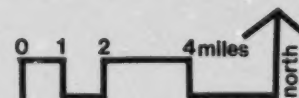
• STORAGE RESERVOIRS

70 PRICE LAKE
71 WASHOE LAKE
72 HOBART LAKE
92 DANGBERG 1&2
93 DANGBERG 3
94 DANGBERG 4
95 BOSC

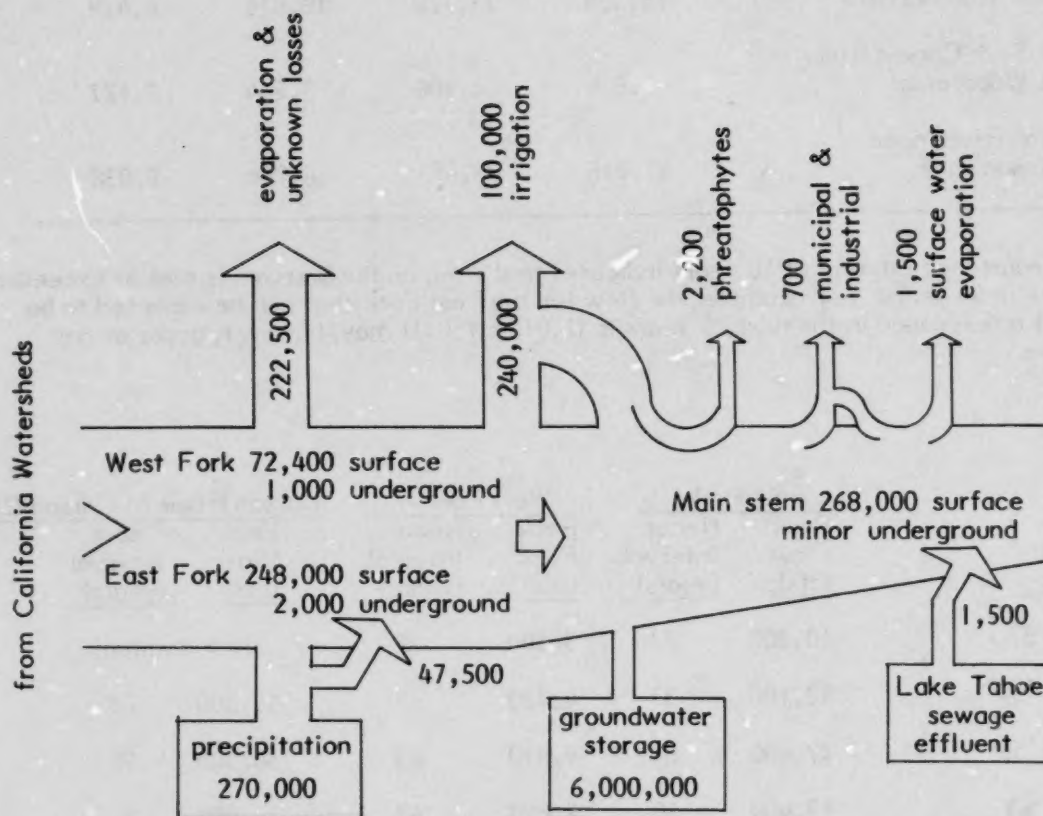
96 MUD LAKE
97 SCOTT LAKE
98 HARVEY LAKE
99 CRATER LAKE
100 INDIAN CREEK
101 RED LAKE
102 FORESTDALE

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B



--All values in acre feet

WATER BUDGET UPPER CARSON RIVER BASIN

FIGURE 19

TABLE 36
 RECURRENCE INTERVALS AND FLOODS OF RECORD FOR
 THE CARSON RIVER¹

<u>Location</u>	<u>Flow in cubic feet per second for recurrence interval</u>			
	<u>100 yrs</u>	<u>50 yrs</u>	<u>25 yrs</u>	<u>10 yrs</u>
East Fork Carson River near Gardnerville	18,568	13,726	10,016	6,419
West Fork Carson River at Woodfords	5,844	4,400	3,264	2,127
Carson River near Carson City	41,218	26,491	16,764	8,838

¹ A recurrence interval of 50 years indicates that flow, on the average, is met or exceeded once in 50 years. For example, the flow for the East Fork that can be expected to be met or exceeded in the next 25 years is 10,016 c.f.s. It may, however, occur at any time.

<u>Date Month/ Year</u>	<u>East Fork</u>		<u>West Fork</u>		<u>Carson River at Carson City</u>	
	<u>Peak Flow (cfs)</u>	<u>Recur. Interval (years)</u>	<u>Peak Flow (cfs)</u>	<u>Recur. Interval (years)</u>	<u>Peak Flow (cfs)</u>	<u>Recur. Interval (years)</u>
Dec. '37	10,300	27	3,500	29	Not Available	
Nov. '50	12,100	37	4,730	59	15,500	22
Dec. '55	17,600	83	4,810	63	30,000	59
Feb. '63	13,400	48	4,890	67	21,900	36
Dec. '64	8,230	16	3,100	21	8,740	10

Source: U.S. Department of Agriculture and U.S. Soil Conservation Service, Special Report: History of Flooding, Carson Valley and Carson City Watershed, 1973.

TABLE 37
BENEFICIAL USES OF SURFACE AND SUB-SURFACE WATER DEVELOPMENTS
UPPER CARSON RIVER BASIN¹

Area Code	Hydrologic Unit, Subunit, Drainage Feature	Description	Mus	Agr	Ind	Gwr	Rec 1	Rec 2	Warm	Cold	Wild	Sal	Pow	Rare	Fish	Receiving Water
633.00	WEST FORK CARSON RIVER HYDROLOGIC UNIT															
633.10	WOODFORDS HYDROLOGIC SUBUNIT															
	WEST FORK CARSON RIVER	Perennial River		X		X	X	X		X	X					Carson Sink
	o SPRINGS		X	X		X	X	X		X	X					West Fork Carson River
	o GROUNDWATER		X	X											X	
	MINOR STREAMS			X		X	X	X		X	X					
633.20	UPPER WEST FORK CARSON RIVER HYDROLOGIC SUBUNIT															
	UPPER WEST FORK CARSON RIVER	Perennial River		X			X	X		X	X					Carson Sink
	WILLOW CREEK	Perennial Stream		X			X	X		X	X					Upper West Fork Carson River
	o SPRINGS		X	X		X	X	X		X	X					West Fork Carson River
	o GROUNDWATER		X	X											X	
	MINOR STREAMS			X		X	X	X		X	X					
632.00	EAST FORK CARSON RIVER HYDROLOGIC SUBUNIT															
632.10	EAST FORK CARSON RIVER HYDROLOGIC SUBUNIT															
	EAST FORK CARSON RIVER	Perennial River		X		X	X	X		X	X				X	Carson Sink
	SILVER KING CREEK	Ephemeral Stream		X		X	X	X		X	X				X	East Fork Carson River
	WOLF CREEK	Perennial Stream		X		X	X	X		X	X				X	East Fork Carson River
	SILVER CREEK	Perennial Stream		X		X	X	X		X	X					East Fork Carson River
	MONITOR CREEK	Perennial Stream		X	X	X	X	X		X	X					East Fork Carson River
	PLEASANT VALLEY CREEK	Perennial Stream		X		X	X	X		X	X					Markleeville Creek
	MARKLEEVILLE CREEK	Perennial Stream		X		X	X	X		X	X					East Fork Carson River
	INDIAN CREEK RESERVOIR	Reclamation Lake		X		X		X		X	X				X	East Fork Carson River
	MILBERRY CREEK	Ephemeral Stream		X		X	X	X		X	X					Markleeville Creek
	LEVIATHAN CREEK (ABOVE LEVIATHAN MINE)	Perennial Stream		X		X	X	X		X	X					Bryant Creek
	LEVIATHAN CREEK (BELOW LEVIATHAN MINE)			(X)		X	(X)	(X)		(X)	(X)					Bryant Creek
	BRYANT CREEK (ABOVE LEVIATHAN CREEK)			X		X	X	X		X	X					East Fork Carson River
	BRYANT CREEK (BELOW LEVIATHAN CREEK)			(X)		X	(X)	(X)		(X)	(X)					East Fork Carson River
	o SPRINGS			X	X	X	X	X		X	X					East Fork Carson River
	o GROUNDWATER		X	X	X										X	East Fork Carson River
	MINOR STREAMS			X		X	X	X		X	X					Carson River

(X) = POTENTIAL USE

¹Beneficial uses are identified in Table 15.

Source: California State Water Resources Control Board, Water Quality Control Plan Report, North Lahontan Basin 6(A), 1975.

for the Carson River and its major tributaries through a public review process. In 1975 the state, with the Carson River Basin Council of Governments, developed a water quality management plan for the Carson River in response to federally mandated statewide planning obligations. This publication lists current Nevada state standards, which are essentially "nondegradation" standards based on existing water quality. The plan was submitted in June 1978 to the state, which then certified the plan and sent it to EPA in December 1978. EPA found the plan deficient in many areas in June 1979.

As required by federal law, the responsibility for the establishing interstate stream standards within the boundary of a state is allocated to the appropriate state authority and to the administrator of the EPA. Interstate standards vary within and between the states and are formulated to represent the conditions of separate streams.

Existing Water Quality and Water Quality Problems. The quality of surface waters in the Upper Carson River Basin is generally excellent. Because the Carson River originates as snowmelt and natural springs, the headwaters contain low mineral concentrations and satisfy the Interim Primary Drinking Water Regulations of the EPA. However, pollutants are being added to the river at numerous downstream points in surface and subsurface irrigation return flows and urban sewage. These pollutants and seasonal low flows have increased the danger of water quality degradation in the Carson River and its tributaries. Table 38 gives water quality parameters and standards and the number of times and places they were violated in 1975.

Areas of concern as defined by the Carson River Basin Council of Governments after comparing existing state water quality standards for the Carson River to the available water quality data include:

- low dissolved oxygen concentrations
- high temperatures
- high ammonia concentrations
- large suspended solid (sediment) loads
- high metal concentrations
- accelerated eutrophication.

During research for the 208 study, sources of pollution were identified. Nonpoint agricultural sources are the largest contributors to pollutant loads. Urban point sources include discharges near Muller Land Bridge on the East Fork Carson River from the Minden-Gardnerville Sanitation District and the Douglas County Sewer Improvement District, discharges near Candlebough Bridge from the Incline Village General Improvement District during the winter months, and continual discharges from Carson City. Carson City is the largest single contributor of urban sewage discharged into the river. In reaches below Carson City, dissolved oxygen concentrations fall below levels needed to support fish life, and toxic ammonia concentrations have been detected directly downstream from the dischargers.

Natural sources of pollution include the disturbance of vegetation as a result of land development and the use of septic tanks in areas not geologically suitable for percolation of effluent. These sources have caused stream siltation problems in the Upper Carson River Basin and large sediment loads along reaches of the Carson River. The results have been high turbidity and excessive nutrients in waters of the river.

TABLE 38
WATER QUALITY PARAMETERS AND STANDARDS
THE CARSON VALLEY AREA, 1975

Pollutant	East Fork			West Fork			West Carson Valley			Carson River		Total # of Violations
	South of Indian Creek	North of Indian Creek, south of Dresslerville	Cotton Slough south of East Fork	At Waterloo Lane	At Centerville Lane	3 miles south of Stateline	Doggett Creek	Blackless Slough at Muller Lane	Ditch east of Blackless Slough at Muller Lane	At Genoa Lane	At Conditrough Bridge	
1. Phosphates (Single value) (mg/l)	8 0.2	— —	33 0.15	— —	— —	38 0.15	— —	13 1.0	12 1.0	8 1.0	6 1.0	118
2. Phosphates (Average) (mg/l)	5 0.10	— —	6 0.10	— —	— —	6 0.05	— —	4 0.50	6 0.50	3 0.50	4 0.50	34
3. Temperature (Single value) (Summer C°/winter C°)	2 30/14	— —	3 30/14	— —	— —	0 25/14	— —	3 30/14	4 30/14	3 30/14	2 30/14	17
4. Temperature (Average) (C°)	0 20	— —	1 20	— —	— —	0 20	— —	1 20	4 20	3 20	2 20	11
5. Fecal Coliform (#/100 ml)	0 1000	— —	0 1000	— —	— —	1 1000	— —	3 1000	2 1000	1 1000	0 1000	77
6. Dissolved Oxygen (mg/l)	0 200	— —	0 300	— —	— —	2 100	— —	1 300	1 300	0 300	1 300	5
7. Dissolved Oxygen (Average) (mg/l)	0 8.0	— —	0 7.0	— —	— —	0 8.0	— —	1 7.0	2 7.0	1 7.0	1 7.0	5
8. Dissolved Solids (Single value) (mg/l)	0 200	— —	0 300	— —	— —	2 100	— —	1 300	1 300	0 300	1 300	5
9. pH (should not exceed) (Range)	1 6.5-9.0	— —	3 6.5-8.5	— —	— —	0 6.5-8.5	— —	0 6.5-8.5	0 6.5-8.5	0 6.5-8.5	0 6.5-8.5	4
10. Biochemical Oxygen demand (mg/l)	0 10	— —	0 10	— —	— —	1 5	— —	0 10	0 10	0 10	0 10	3
11. Chlorides (mg/l)	1 10	— —	0 15	— —	— —	1 6	— —	0 20	0 20	0 20	0 20	2

Low dissolved oxygen, high temperatures, and high concentrations of suspended solids (sediments) are directly related to low summer flows. Concentrated sediment loads cause accelerated eutrophication and a rise in free ammonia to toxic levels. As a result, fish kills and migration blocks have occurred during the summer.

Water quality problems could also result from metals such as mercury, iron, and manganese in the sediments. The Leviathan Mine, an idle sulphur mine on Leviathan Creek, is a source of pollution to Bryant Creek, an interstate stream tributary to the East Fork Carson River. Leviathan Creek transports water that has been polluted with iron, sulphates, arsenic, and other dissolved minerals by seepage through tailings. Only through dilution by Mountaineer Creek and other tributaries is the water quality of Bryant Creek improved sufficiently for pasture irrigation. During periods of low flow and insufficient dilution, the concentrations of acids and minerals in the creek become too high to support fish life. Waters diverted from Bryant Creek for irrigation generally do not reach the Carson River; however, during periods of no diversion, water quality problems in the Carson River could arise.

Of primary concern for this EIS is the potential problem resulting from use of secondary treatment by STPUD and DCSID for irrigation in the Carson Valley. Although this disposal method would eliminate violations of discharge requirements for the Carson River, the effluent would percolate through soils and possibly contaminate groundwater.

Groundwater reserves in the Upper Carson River Basin are of excellent quality. Observations of the Carson River Basin Council of Governments indicate that the groundwater is unpolluted by human activity and that high quality has generally been made available as a result of irrigation.

Indian Creek Reservoir in the California part of the Upper Carson River Basin is dependent on effluent it receives from STPUD. Table 39 lists the results of a water quality study of Indian Creek Reservoir conducted in 1977. The limiting nutrient in the reservoir is phosphorus; as it increases, so does the algal population. Algal photosynthetic activity results in carbon dioxide and alkalinity imbalances, which cause a rise in the pH of the reservoir and the release of free ammonia. During the spring, bottom nutrients mix with surface waters and increase algal growth and free ammonia concentrations, resulting in fish kills.

TABLE 39

WATER QUALITY FOR INDIAN CREEK RESERVOIR

Parameter	mg/l
Suspended Solids	4.2
Volatile Solids	2.2
Total Organic Carbon	9.0
Total Chemical Oxygen Demand	26.0
Inorganic Carbon	33.0
Inorganic Nitrogen	9.7
Phosphorus	0.3
Alkalinity	>100
pH	8.2 Units

Source: Middlebrooks and Associates, 1978.

IMPACT ASSESSMENT

Water quality impacts stem from disposal of effluent into Carson River. The effects of proposed changes in the disposal of effluent are discussed in "Utilities."

Question: To what extent will development be affected by flood hazards?

Measurements

	<u>Growth Scenarios</u>				
	1	2	3	4	5
Damage levels	Low	Medium	Medium	High	High

The relative increases in flood hazards resulting from increased development and runoff would not be critical. Therefore this question is directed to limitations on potential development created by flood hazards.

Description

Flooding caused by high groundwater conditions, a large drainage area, and an extensive floodplain have caused significant damage in the Carson Valley. These natural conditions, combined with the fact that building regulations are not strictly enforced, has led to the current problems.

The degree of flood hazard will increase proportionally with the degree of development projected under each growth scenario as pressures to develop land within the 100-year floodplain occur. (Current zoning does not provide for high density development within the floodplain.)

Critical Implications

Flood hazards will limit available land for development, as well as increase the cost for development in flood-prone areas. For residences in flood-prone areas, waterproofing or other measures may be implemented at a cost of 10 to 20 percent of the total cost of a home. Measures for controlling runoff would include storm drainage facilities for urban areas at relatively high costs. Major control measures for the Carson River Basin such as the Watasheamu Project have been proposed at a cost of \$57 million.

MITIGATION MEASURES

1. Implement land use controls.

Description. To prevent flooding damage to property, the most feasible mitigation measure is to identify extent of 100-year floodplain and to limit land uses within the floodplain area. Douglas County zoning already calls for very low-density residential use in most of the floodplain area. Floodplains should be mapped and zoning updated to correspond.

Effectiveness. Can be highly effective if implemented as part of a comprehensive land use program.

Responsibility. Douglas County.

Cost. Administrative.

Timing. Coordinate with update of Douglas County General Plan.

4. NOISE

EXISTING CONDITIONS

Because of the low density of the urban areas and the amount of natural open space, few people in the Upper Carson River Basin are bothered by a noise at any one time. Occasionally, heavy trucks produce disturbing noise levels, but, in general, noise levels from all vehicular traffic are well within the accepted federal standard of 70 dBA (exceeded only 10 percent of the time over a 24-hour period at the exterior wall of a dwelling). Noise levels are highest in urban areas, near industrial operations and along traffic corridors.

IMPACT ASSESSMENT

Question: How will spillover population be affected by major noise sources?

Measurements

	1	2	<u>Growth Scenarios</u>		5
			3	4	
Increase in persons affected by aircraft flyovers					
Impact rating	Low	Low	Low	Low	Low
Increase in persons affected by traffic noise					
Impact rating	Low	Low	Medium	Medium	Medium
Increase in commuters to the Lake Tahoe Basin					
Impact rating	1,624 Low	1,311 Low	2,735 Low	8,118 Medium	7,210 Medium

Impacts of traffic noise are assumed to be directly related to the magnitude of the spillover population and the number of workers commuting to the Lake Tahoe Basin. The number of persons affected by noise would increase with the population density in key areas.

Description

There are few noise problems in the Carson Valley, but as population density increases, ambient noise levels can be expected to rise.

Under Scenarios 4 and 5, where the number of commuters from Carson Valley to the Lake Tahoe Basin increases substantially, the level of traffic-related noise will also increase.

Airport operations at the Douglas County airport will have a minimal impact because development in the vicinity is assumed to be moderate and because the airport is expected to remain a small-scale, general aviation facility.

Critical Implications

The noise implications of additional growth are not critical. If substantial residential and commercial development occurs along U.S. 395, a greater number of persons may be affected by automobile and truck noises. However, such impacts can be mitigated through adoption of measures that separate noise-sensitive from noise-generating areas.

MITIGATION MEASURES

Because noise is not expected to create adverse impacts, a discussion of mitigation measures is unnecessary. Nevertheless, Douglas County should begin to consider acoustical site planning before expected development takes place in the late 1980s. Alpine County is not likely to encounter significant noise impacts; however, noise considerations can be incorporated easily into present site planning. Acoustical site planning encompasses techniques such as increasing the distance between noise sources and receivers; placing land uses or structures that are not noise sensitive between the source and the receivers; placing structures parallel to major roadways to act as shields; and constructing facilities away from noise sources. These measures would be highly effective because extensive building construction and subdivision development have not yet occurred, and can be easily incorporated into existing zoning or subdivision ordinances or into local building codes.

5. METEOROLOGY AND AIR QUALITY

EXISTING CONDITIONS

Meteorology

The climate of the Upper Carson River Basin is strongly influenced by the presence of the Carson Range to the west and the Pine Nut Mountains to the east. Wind directions and precipitation, in particular, are modified by the topography.

Wind during the day blows north or south parallel to the flanking ridges. The northerly winds are more prevalent due to the influence of the semi-permanent Pacific high pressure region. Mountain and valley winds at the base of the ridges blow east and west. At night mountain winds flow from the ridges into the basin and combine with the dry air of the region to form a nocturnal stable layer (inversion). During these stable conditions, pollutant dispersion is poor.

The Upper Carson River Basin receives relatively little rain--only an average of 12 inches each year--whereas the Lake Tahoe Basin, just to the west, receives about 28 inches each year. The difference is due to the lower elevation (1,500 feet) of the Carson River Basin. As Pacific storms move east over the Carson Range, the drop in surface elevations causes the air to sink, which diminishes precipitation from the storms. In a semi-arid climate such as this, the lifting of surface particles contributes to the concentration of total suspended particulates (TSP) in the air.

Air Quality

The air quality of the Upper Carson River Basin is generally good. With the exception of oxidant, the region is classified as an attainment area (Nevada Dept. of Conservation and Natural Resources, 1977). The Nevada and federal air quality standards are shown in Table 29, in Lake Tahoe Basin "Meteorology and Air Quality." Carson City is classified as a nonattainment area for oxidants. (Monitoring and standards are in terms of ozone, the principal constituent of oxidants.) In 1976 thirty-seven violations of the 1-hour ozone standard ($160 \mu\text{g}/\text{m}^3$) were recorded, with the second highest concentration equalling $204 \mu\text{g}/\text{m}^3$. (The standard has since been relaxed to $235 \mu\text{g}/\text{m}^3$.) A plan to bring the area into attainment was submitted on January 1, 1979. The ozone is thought to result primarily from downward transport of natural ozone in the lee waves east of the Sierra and the transport of ozone and precursor pollutants from the Reno area. The recent lowering of both the Nevada and the federal standard for oxidants may enable the Carson City area to become an attainment area.

Carbon monoxide (CO) is not now monitored in the Upper Carson River Basin. However, earlier measurements in the Minden-Gardnerville area indicated the basin is in attainment of the CO standards.

The Upper Carson River Basin is considered an attainment area for TSP. The 24-hour state TSP standard ($150 \mu\text{g}/\text{m}^3$) was equalled in one instance only, in 1977 in Carson City, but this level did not violate the federal standard ($260 \mu\text{g}/\text{m}^3$).

IMPACT ASSESSMENT

Question: How will air quality in the Carson Valley be affected?

Measurements

	1978	1	2	<u>Growth Scenarios</u>		
				3	4	5
Peak hour carbon monoxide concentration (ppm) in Minden	0.3	2.2	2.2	2.2	2.2	2.2
Impact rating		None	None	None	None	None

Impacts of oxidant levels were not specifically evaluated for the Upper Carson River Basin because precursor concentrations are very low. It seems ozone levels here are not caused by local conditions.

Although Minden currently has no CO problems, it was considered possible that the effects of growth in the region could create some. Accordingly, a dual scale analysis of CO was performed using the methodology reported in the Lake Tahoe air quality section. Traffic data and projections were provided by the Nevada Department of Highways (1979) and were adjusted to reflect the five alternative growth scenarios (Conradt, pers. comm.).

Description

The projections of CO in year-2000 indicate that the air quality standards will be neither approached nor violated in the Minden area. No negative impacts are anticipated elsewhere in the basin.

MITIGATION MEASURES

As there are no adverse effects on air quality, no discussion of mitigation measures is necessary.

6. VISUAL RESOURCES

EXISTING CONDITIONS

The visual quality of the Upper Carson River Basin is unusually high. There are several roadways units, however, that are especially vulnerable to visual deterioration because they are of exceptional visual quality and undeveloped at present or

are highly visible from other areas. These roadway units are shown below:

- Highway 89, western entrance to the Upper Carson River Basin
- Highway 89, between northern end of Hope Valley and Carson Pass exit from the basin
- Blue Lakes Road
- Highway 89, between Hope Valley and Carson Valley
- Highway 89/Highway 4, between Woodfords and Markleeville.

IMPACT ASSESSMENT

Question: How will visual resources be affected?

Measurements

	Growth Scenarios				
	1	2	3	4	5
Acres of agricultural or undeveloped land replaced by residential development					
Douglas County	211	171	356	1,057	939
Impact rating	Low	Low	Medium	High	High
Alpine County	67	54	113	334	297
Impact rating	Low	Low	Medium	High	High
Number of new or enlarged roads					
Douglas County					
Impact rating	Low	Low	Low	Low	Low
Alpine County					
Impact rating	None	None	None	None	None
Visibility (air pollution)					
Impact rating	None	None	None	None	None

Ratings assume that the high visual quality of the Upper Carson River Basin is due in large part to the natural character of the setting and that this visual quality would be diminished by significant new development. Changes would include more structures for residential use, an expanded roadway system, and reduced air quality due to increased traffic. (Increases in commercial use were not projected for the

growth scenarios; commercial uses are expected to increase in proportion to new residential growth in already developed, commercially zoned lands near Minden-Gardnerville.)

For Douglas County, new households are assumed to be constructed first in areas zoned for medium-density, single-family dwelling units at an average of six dwelling units per acre (R-1, R-2, R-3, and E-1 zones are designated by the Douglas County General Plan).

Alpine County does not designate residential densities beyond one unit per acre. For this reason, only 5 percent of the growth projected for the basin is assumed to occur in Alpine County, at residential densities of one single-family dwelling per acre.

Ratings are descriptive and compare various levels of growth projected by the scenarios.

Description

Impact of development on visual conditions in the Douglas County parts of the Upper Carson River Basin would be especially apparent in the valley floor and on mountain slopes surrounding the floor. Development here would be highly visible from all roadways. Degree of impact would increase with level of development.

Development in Alpine County would have an adverse effect if it is visible from roadways or if new roadways are required to serve the development. Lands zoned for residential use (special districts or residential) lie along all roadway units in Alpine County. These units could undergo significant deterioration in quality at high levels of growth (Scenarios 4 and 5), especially if zoned lands are developed.

Critical Implications

Replacement by development of agricultural or undeveloped land in the Upper Carson River Basin and a corresponding increase in roadways to serve the additional population would significantly change the visual character of the basin. Under Scenarios 4 and 5, visual degradation could be severe.

MITIGATION MEASURES

1. Adopt areawide design plan to guide location and type of development.
2. Update zoning ordinance to prevent scattered, low-density development.
3. Adopt ordinance to prevent development on steep slopes visible from roadways.
4. Develop transportation plan to prevent increases in air pollution and reduction in visibility.
5. Designate scenic roadways to prevent alteration or degradation of most valuable roadway units.

G. INDIRECT EFFECTS (SECONDARY IMPACTS): CULTURAL ENVIRONMENT IN UPPER CARSON RIVER BASIN

I. LAND USE

EXISTING CONDITIONS

Carson Valley and the Upper Carson River Basin parts of Alpine County are historically, economically, and socially a unit.

Landownership

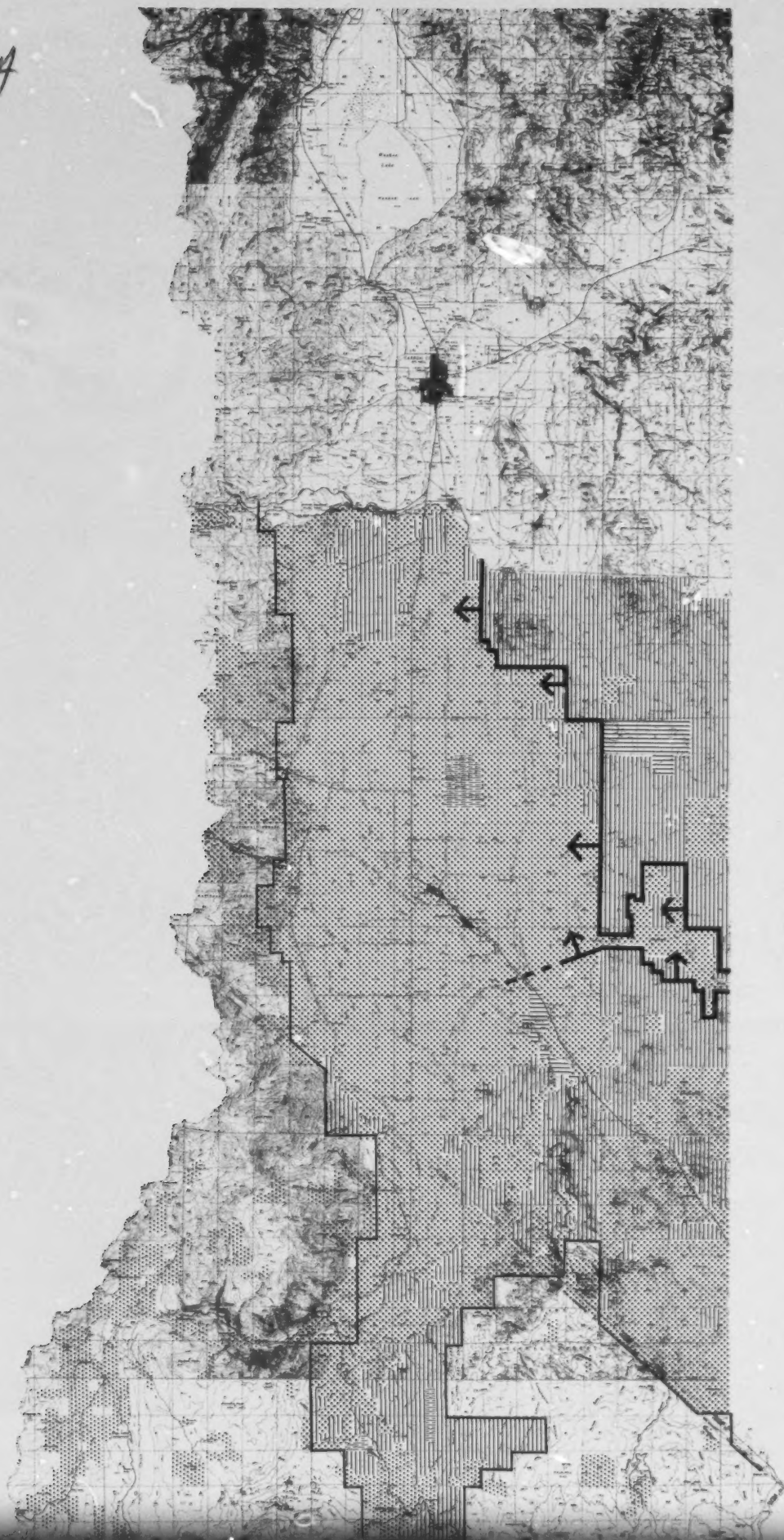
The U.S. Forest Service and the Bureau of Land Management (BLM) are the largest landowners in the Upper Carson River Basin, but private land is extensive and concentrated in large holdings. Figure 20 is a map of landownership in the study area; ownership is summarized in Table 40.

In the Carson Valley, Forest Service lands are concentrated in the Carson Range on the west side of Carson Valley, and BLM lands are concentrated in the Pine Nut Mountains and on their western slopes. The Dangberg Ranch northwest of Minden, formerly the largest single private holding in the valley, is being divided into smaller holdings. Native American allotments are scattered throughout the Pine Nut Mountains, but most are outside the study area. The most important Native American holdings in the study area are the Dresslerville Ranch Indian Reservation and Washoe Ranch on the East Fork Carson River. The county has small public holdings in the Douglas County Airport and other miscellaneous parcels. The state has only minor holdings, the most notable being the Mormon Station Historic State Monument at Genoa.

Substantial changes in landownership in Carson Valley are likely. BLM plans to dispose of substantial land, as indicated on Figure 20. It is the policy of the Forest Service to consolidate its holdings within the boundaries of the forest through trades with private landowners, transfers with BLM, and outright purchase. Private land speculation is resulting in substantial division and transfer of land. Information on private land division and transfer is limited, however, because state law places almost no limitations or requirements on subdivisions resulting in parcels of 40 acres or more in area.

In Alpine County, 92 percent of the entire land area (including land both within and outside of the Upper Carson River Basin) is federally owned. Most of this land is managed by the Forest Service, but substantial areas in the Diamond Valley between Markleeville and Woodfords are managed by the BLM. It is in these areas that Indian Creek Reservoir is situated. Grovers Hot Springs State Park west of Markleeville is partly on land owned by the state and partly on land leased from the Forest Service. Alpine County owns Turtle Rock Park, north of Markleeville on former BLM land, the airstrip near Indian Creek Reservoir, and miscellaneous parcels; the county corporation yard at Woodfords is on land leased from the Forest Service.

A



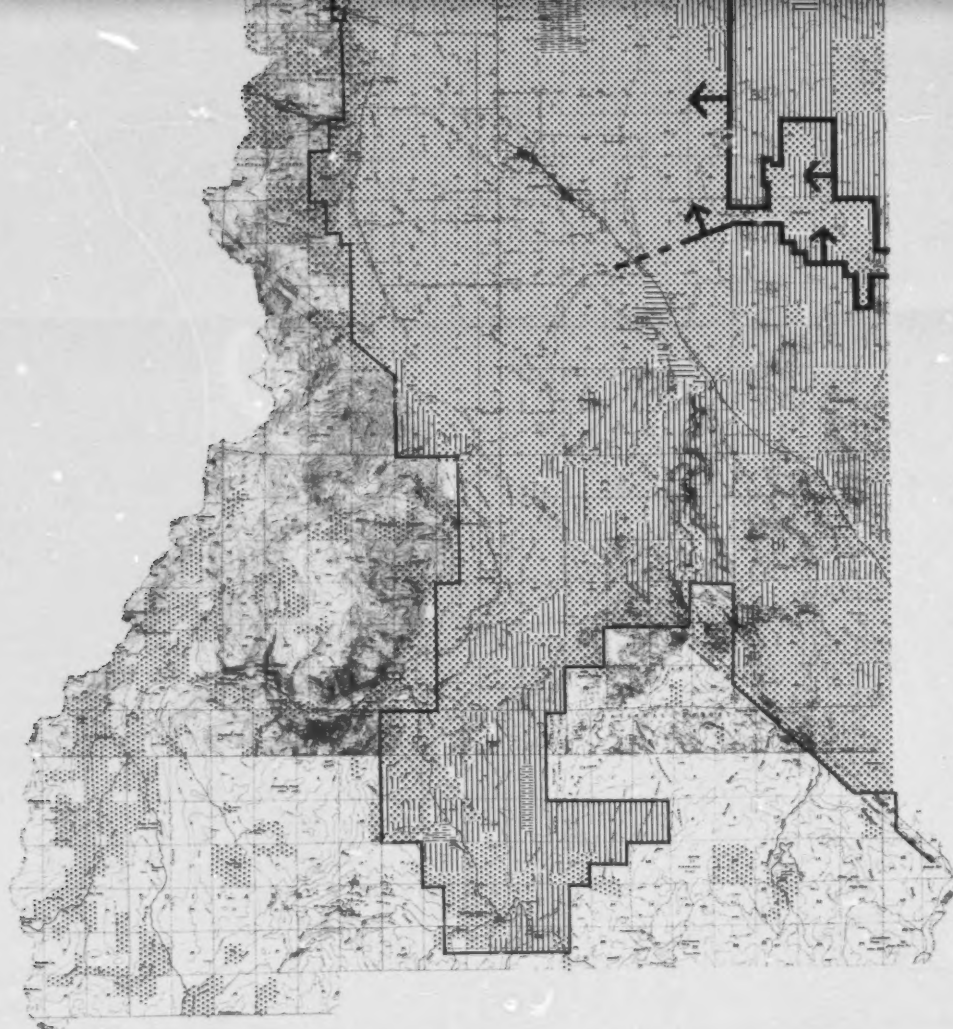
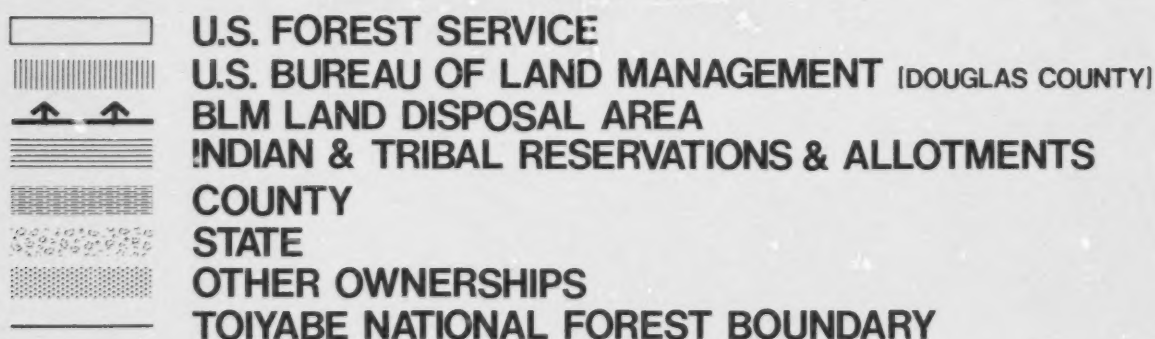


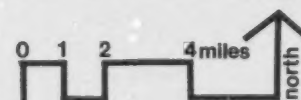
**Figure 20 LAND OWNERSHIP
UPPER CARSON RIVER BASIN**



Tahoe Region Environmental Evaluation Study

U.S. Environmental Protection Agency
Sedway/Cooke

B



TABLE

LANDOWNERSHIP IN THE STUDY AREA PARTS OF
DOUGLAS AND ALPINE COUNTIES

Owner	Douglas County		Alpine County		Total	
	Acres	%	Acres	%	Acres	%
U.S. Forest Service	11,900	6	91,400	66	103,300	32
BLM	53,300	29	11,600	8	64,900	20
Indian and Tribal Reservations and Allotments ¹	2,300	1	0	0	2,300	1
County ¹	900	-- ²	500	-- ²	1,400	-- ²
State ¹	0	0	400	-- ²	400	-- ²
Other	116,400	63	35,000	25	151,400	47
Total	184,800	100	138,900	100	323,700	100

¹ Incomplete information

² Less than 0.5%

Source: Sedway/Cooke; all figures are approximate; percentage may not add due to rounding.

Some changes in landownership in Alpine County are likely. The Forest Service plans to consolidate its holdings within the boundaries of Toiyabe National Forest, but resources are limited. Notes on the Hope Valley area in the Land Management Plan for the Alpine planning unit (U.S. Forest Service, 1977, p. 91) state, "The priority for government acquisition of those lands is low at this time." However, the plan contains, in addition, the management decision to "... determine the feasibility and need to acquire highly valued private lands, subject to development proposals, into the National System" (p. 93). BLM may dispose of its holdings some time in the distant future, although the bureau's management framework plan does not specifically provide for disposal of those lands (Beals, pers. comm.). Sierra Pacific Power Company, which has acquired extensive lands in Woodfords Canyon and elsewhere in the county for a reservoir in Hope Valley, is said to want to sell the land because the reservoir is not a viable project (Turnbeaugh, pers. comm.).

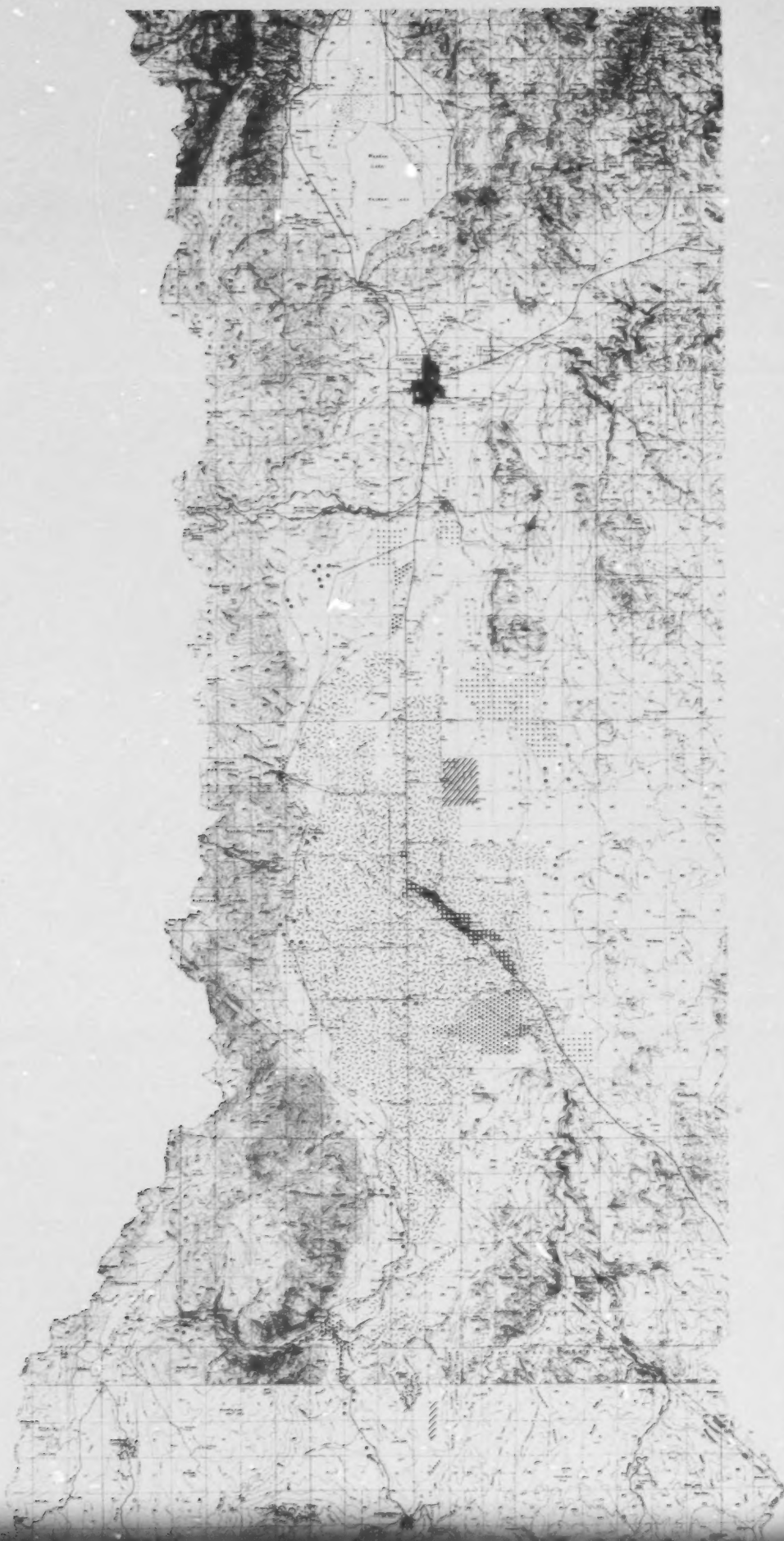
Land Use

The dominant land use is agriculture and open space. Residential and other urban land uses are limited, as shown in Figure 21. Figure 22 shows the location of residential land uses by traffic zone (the field survey on which the figure is based did not count mobile homes).

Almost all agricultural land in the Carson Valley is devoted to irrigated pasture and forage crops, cattle raising, and dairy farming. Of the developed lands, most is in residential use at low (1.5 dwelling units per acre) to medium (over 2 dwelling units per acre) densities. Higher urban densities (about 3 to 8 units per gross acre) are confined to Minden-Gardnerville and some scattered sites. New development, such as Gardnerville Ranchos, is medium density. The only industry in the valley is the Bentley Corporation, which has electronics manufacturing plants at the airport and in Minden. With the exception of a few small groceries and restaurants, all commercial uses are concentrated around U.S. 395 in Minden and Gardnerville. Public land uses include the airport, the courthouse, the Minden Library, and schools in the Minden-Gardnerville area.

Alpine County has rough terrain and severe winters. As a result, the population is small, and the land is almost entirely in open space. There is some limited irrigated agriculture in the Carson Valley and Diamond Valley parts of the county, and the Hope Valley area is used for cattle grazing. There are a few small recreational facilities in Hope Valley and Woodfords Canyon east of Woodfords (Sorensen's Resort, with about six cabins). With the exception of a few small subdivisions in the Paynesville area north of Woodfords, almost all residential and related land uses are confined to the Woodfords and Markleeville areas. In the past, small stores and gas stations were situated in Woodfords, but all commercial uses are now in Markleeville. Public land uses, which include the county corporation yard, Diamond Valley School, the courthouse, and the courthouse annex, are in the Woodfords and Markleeville areas. Public recreation is scattered throughout the county and includes Forest Service campgrounds in the Toiyabe National Forest; a BLM campground at Indian Creek Reservoir; and a campground, a day-use area, and pools at Grovers Hot Springs State Park.

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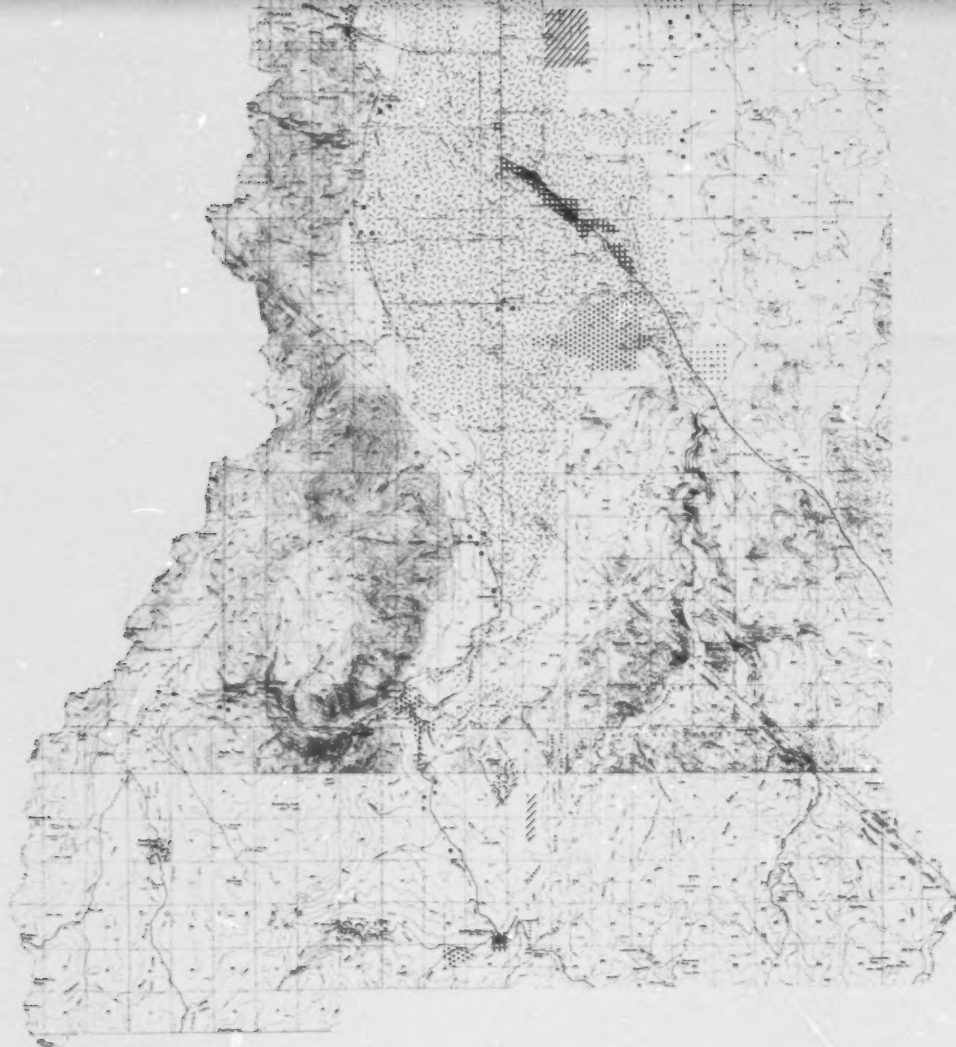
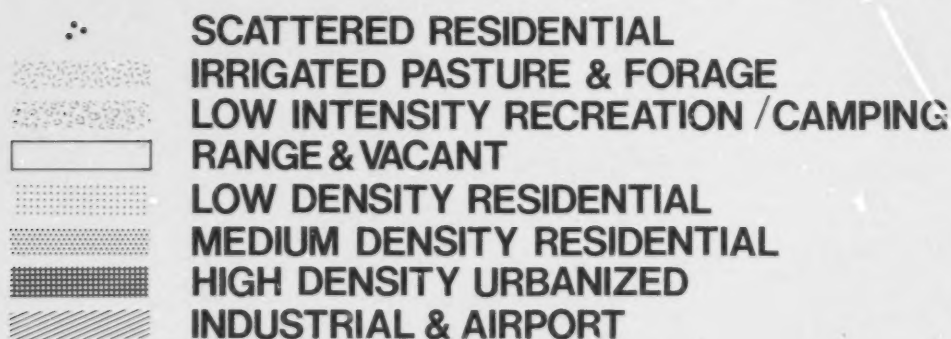


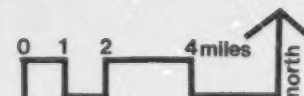
**Figure 21 EXISTING LAND USE
UPPER CARSON RIVER BASIN**



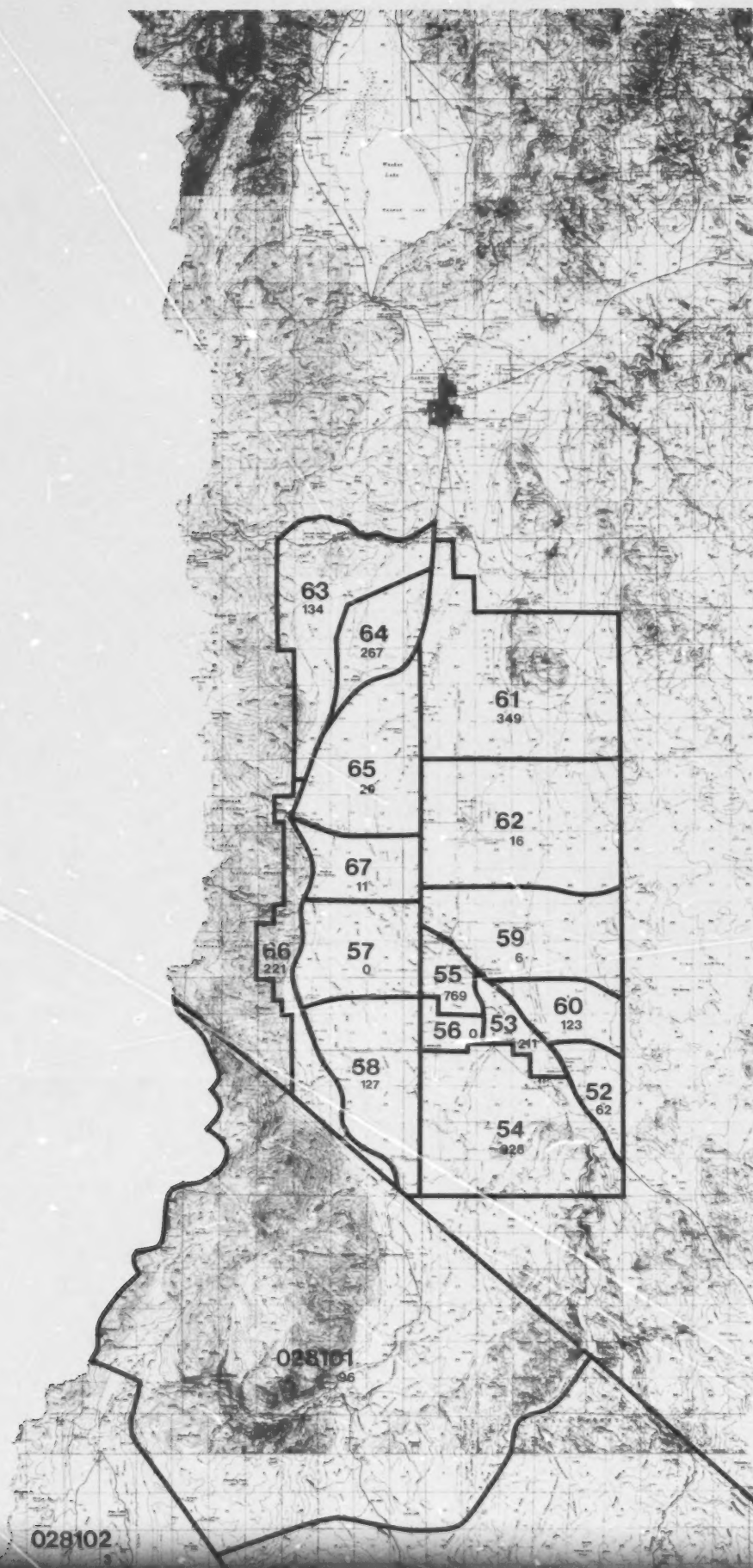
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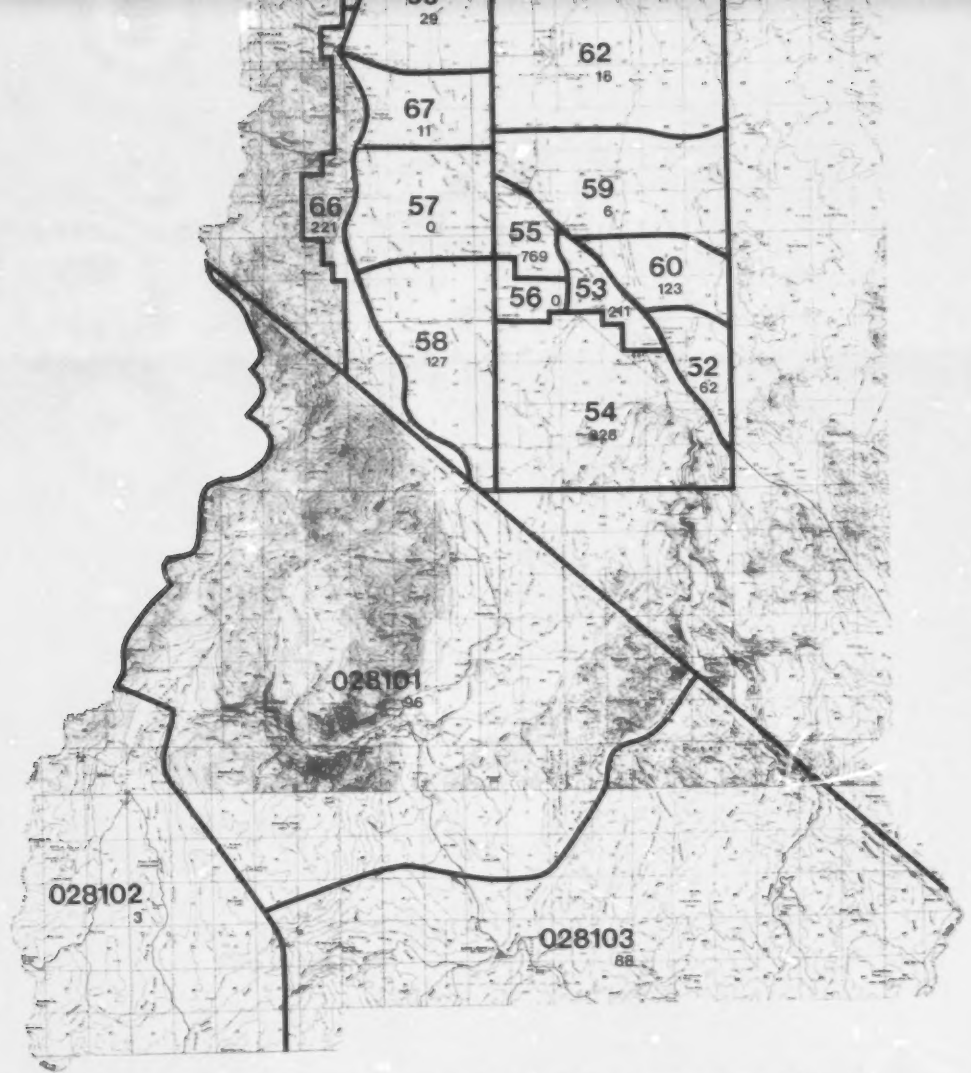


**Figure 22 LAND USE BY TRAFFIC ZONES
UPPER CARSON RIVER BASIN**



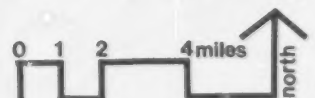
TRAFFIC ZONE

6

**NUMBER OF DWELLING UNITS-NOT
INCLUDING MOBILE HOMES**

Tahoe Region Environmental Evaluation Study

U.S. Environmental Protection Agency
Sedway/Cooke



B

Land Use Policy and Plans

In Douglas County, land subdivision is controlled by the Douglas County Subdivision and Parcel Map Ordinance (Douglas County Code, Chapter 16.04 et seq.) and by the Nevada Revised Statutes (Chapters 117, 278, and 278A). The subdivision ordinance discourages any land division that is inconsistent with either the Douglas County Master Plan or Zoning Ordinance. (Zoning takes precedence if there is any discrepancy (Douglas County Code, Sec. 16.08.030-(B)(5).)) Under state law, the subdivision ordinance does not apply to land divisions creating parcels of 40 acres or more.

The 1970 census counted a population of 3,867 for the Carson Valley (including Topaz). Since then several estimates of the county's ultimate population have been made indicating that existing land use policy would permit anywhere from 21,690 to 63,107 dwelling units.

The Alpine County General Plan was adopted in 1974. Its zoning ordinance (Ordinance no. 243) was adopted in 1964 and has been amended a number of times since. Whereas Douglas County's plan and zoning permit a similar, though not identical, holding capacity and land use distribution, the Alpine County zoning ordinance permits substantially less development than the general plan. In order for development to occur, land must be rezoned and must be consistent with the plan. Scattered, small-scale development is thereby discouraged.

Subdivisions in Alpine County are regulated by the county subdivision ordinance (Ordinance no. 359-76, adopted May 17, 1976, and amended). California state law requires that subdivisions be consistent with the general plan.

Development Proposals

Three major developments have been proposed in Carson Valley. As of the writing of this section, all have been turned down by the county planning commission but will be appealed to the board of commissioners. Westwood Village would involve commercial uses and 460 units, with about 1,500 people on 460 acres next to Douglas High School. Newman Construction would construct 375 to 450 units on 141 acres on the former H.H. Godecke Ranch off Buckeye Road in Minden. The Fremont "new town" west of U.S. 395 near the Carson City line would add 4,000 dwelling units, 10,000 people, and commercial and public facilities. On the other hand, proposal for 462 units in two subdivisions southeast of Gardnerville was approved by the Douglas County commission in April 1979.

Existing subdivisions contain 7,112 vacant lots. The largest number are in Gardnerville Ranchos (2,210 vacant lots), the Johnson Lane area (1,800) and Indian Hills (1,500) (Douglas County Fire Department, 1978).

Alpine County approved two small subdivisions totaling 60 units in Markleeville in mid-1978. Other development proposals for the Paynesville area (16 parcels on 80 acres) and Hope Valley (an 800-acre resort) have been turned down because of deficiencies in sewage treatment, water supply, telephones, and electricity. The controversy over "Constitution City", a 600-acre site owned by Sierra Alpine

Associates northwest of Markleeville continues. Alpine County officials have charged that the owners have attempted to circumvent the state Subdivision Map Act in order to develop a community of houses, schools, and shopping facilities.

IMPACT ASSESSMENT

Question: How will existing land uses be affected?

Measurements

	1	2	<u>Growth Scenarios</u>		5
			3	4	
Increase in land area and dwelling units in residential land use					
Douglas County					
Total dwelling units	1,268	1,024	2,138	6,343	5,634
Acres	211	171	356	1,057	939
Impact rating	Medium	Medium	Medium	High	High
Alpine County					
Total dwelling units	67	54	113	334	297
Acres	67	54	113	334	297
Impact rating	Medium	Medium	Medium	High	High

Increases described above include only spillover growth from the Lake Tahoe Basin. Levels of residential growth have been assigned to the two counties in the study area as follows:

- 95 percent to Douglas County; six dwelling units per acre
- 5 percent to Alpine County; one dwelling unit per acre

Increases in commercial uses were not projected for the spillover growth scenarios and so are not described above; however, it is expected that no more than 716 acres (total amount of commercially zoned land in Douglas County) will be developed for commercial uses to secure new residential growth in commercially zoned areas along U.S. 395 in Minden-Gardnerville. Because a low population growth is projected for Alpine County, the commercial growth projected for Markleeville is minimal.

Description

The effect in Douglas County of projected levels of growth for the study area would be to increase residential land use and to decrease the amount of land now in agricultural production or undeveloped. Residential units would be constructed first in traffic zones 53, 55, 59, and 60 (all concentrated around the Minden-Gardnerville area) and on 460 acres zoned R-1, R-2, and R-3. Another 597 acres of medium-density housing would be constructed in traffic zones 59, 60, 65, 66, and 67 on E-1 zoned lands. These latter traffic zones are located in agricultural areas and areas of biological resources. Development in these areas would have a greater impact on the physical and cultural environment than those near Minden-Gardnerville (see "Visual Resources" for the Upper Carson River Basin).

In Alpine County, the low level of growth projected (maximum 334 acres under Scenario 4) would have little impact on the physical and cultural environment unless these acres are developed within viewing distance of major roadways or in the vicinity of archaeological or biological resources (see "Biology", "Visual Resources," and "Cultural, Archaeological, and Historical Resources"). Lands zoned for specific residential densities (RS) allow for a total of 2,733 lots on 2,510 acres and are located generally in the areas of existing development or major roadways (Markleeville, Diamond Valley, and Highway 89).

Critical Implications

Increased development from spillover from the Lake Tahoe Basin (and resulting land use changes) could affect visual conditions, biological resources, and water quality. For discussion of effect on specific factors, see other sections of this report. With growth pressures from other areas such as Reno or Carson City, growth and land use changes from spillover could have a major impact on the environment.

There is increasing sentiment for "slow-growth" and "no-growth" in both Carson Valley and Alpine County. Major projects in both areas have been turned down or delayed indefinitely. If there are significant changes in the land use policy of the two counties, the Upper Carson River Basin might not be able to accommodate all spillover development from the Tahoe Basin, Carson City, and Reno. Housing prices in all areas could be expected to rise faster than the average housing inflation rate as competing households bid up the prices of the limited supply of housing.

In addition, the Nevada state engineer has imposed a moratorium on well drilling. This restriction may have the effect of forcing development to locate within service distance of the Minden and Gardnerville water systems and may limit population growth until surface diversion can be developed.

MITIGATION MEASURES

Mitigation measures for impacts resulting from land use changes are discussed under appropriate factors. Refer to specific sections.

2. HOUSING

EXISTING CONDITIONS

As employment has grown in the south shore, Carson City, Reno, and in Carson Valley itself, demand for housing in Douglas County has grown. The 1970 census of housing reported that the county had 3,205 dwelling units, of which 120 were seasonal (Douglas County, 1974, p. 31). 1969-1970 marked the beginning of a construction boom in Carson Valley. In 1970, 137 housing permits were issued; in 1973, 239 permits were issued (Douglas County, 1974, p. 31). Virtually all of these permits were for single-family dwellings. Last year 800 housing permits were issued, and this year 1,000 are expected to be issued (Smith, pers. comm.). Future development plans call for larger numbers of multiple-unit dwellings (Smith, pers. comm.).

Carson Valley housing prices have risen rapidly as a result of high demand. In 1973 the median value of a single-family dwelling was \$28,800 (Douglas County, 1974, p. 32), and median family income was \$10,773 (Carson River Basin Councils of Government, 1973). In 1978 the average price of a new house in Carson Valley was \$50,000 (Smith, pers. comm.). Although appreciation has been significant, housing prices in Carson Valley are still below levels for comparable units in the Lake Tahoe Basin or in the other areas from which housing demand is shifting. The demand pressure on the valley housing market will continue to be strong and to push land and housing prices upward.

Mobile homes are a significant form of housing. There are over 100 units in the Minden-Gardnerville area and 230 in the valley (Douglas County, 1974, p. 32). Although demand for this relatively inexpensive type of housing will continue, zoning regulations may limit mobile homes to Jacks Valley in the northern end of Carson Valley and Topaz in the southern end.

In Alpine County, the 1977 estimate of county housing units was 807, with 486 units (60 percent) vacant, most held for seasonal use. These units housed 827 people. Nine mobile homes housed an additional 23 people (California Dept. of Finance estimates).

Recently built homes have been in the \$50,000 and up range (Turnbeaugh, pers. comm.). The past and present shortage of low-cost housing has been a particularly acute problem for the Native American population. High housing prices result from Alpine County's distance from major supply sources, the high price of building sites, the short building season, and the special engineering required for roof snow loads and lateral stress. These factors make it improbable that much relatively moderate cost housing will be built in the future.

The recent approval of a 60-unit development near Markleeville indicates that growth pressures will continue. County officials have taken a strong stand on standards developers must meet. As a result of both demand and supply factors, large-scale development in moderate price ranges is considered unlikely for most areas of the county.

IMPACT ASSESSMENT AND MITIGATION MEASURES

For impacts associated with increased spillover population into the Upper Carson River Basin and for approaches to mitigate subsequent adverse impacts, refer to Lake Tahoe Basin "Housing".

3. TRANSPORTATION

EXISTING CONDITIONS

Figure 23 shows the principal roads in the Upper Carson River Valley and Figure 24 shows 1977 annual average daily traffic volumes (AADT) in Douglas and Alpine Counties. Traffic volumes shown are not heavy enough to overload any segment of the road system. However, past traffic growth in Douglas County has been substantial, and summer traffic in Alpine County is approximately double the AADT.

During the 10-year period from 1963 to 1973, traffic increased 43 percent to 148 percent at various points on U.S. 395 in Gardnerville; 77 percent between Gardnerville and Minden; and more than 100 percent on Nevada Highway 88 just south of the junction with U.S. 395.

The Douglas County General Plan (1974) discussed possibilities for future roads, as indicated in Figure F-4 (Douglas County, 1974). A freeway bypass to the east of existing U.S. 395 and the relocation of Nevada Highway 88 to connect to the proposed freeway would send through traffic around Minden and Gardnerville, and existing Nevada Highway 88 and U.S. 395 could be used as main streets for the community. The plan also suggested the construction of arterial bypasses on the north and south sides of development in Minden and Gardnerville.

In addition to the road system, two bus companies provide inter-city services. The Tahoe Airporter carries passengers between Lake Tahoe and Reno International Airport via Carson City. There is no local transit service in the study area.

Heavy snowfall closes most of the roads in Alpine County for nearly half the year. However, Highways 88 and 89 are kept open, and they form a route across the northern part of the county. Traffic congestion seldom occurs on this route, even in summer. Access to the Woodfords and Markleeville areas is maintained in all seasons. There is no public transportation except school buses.

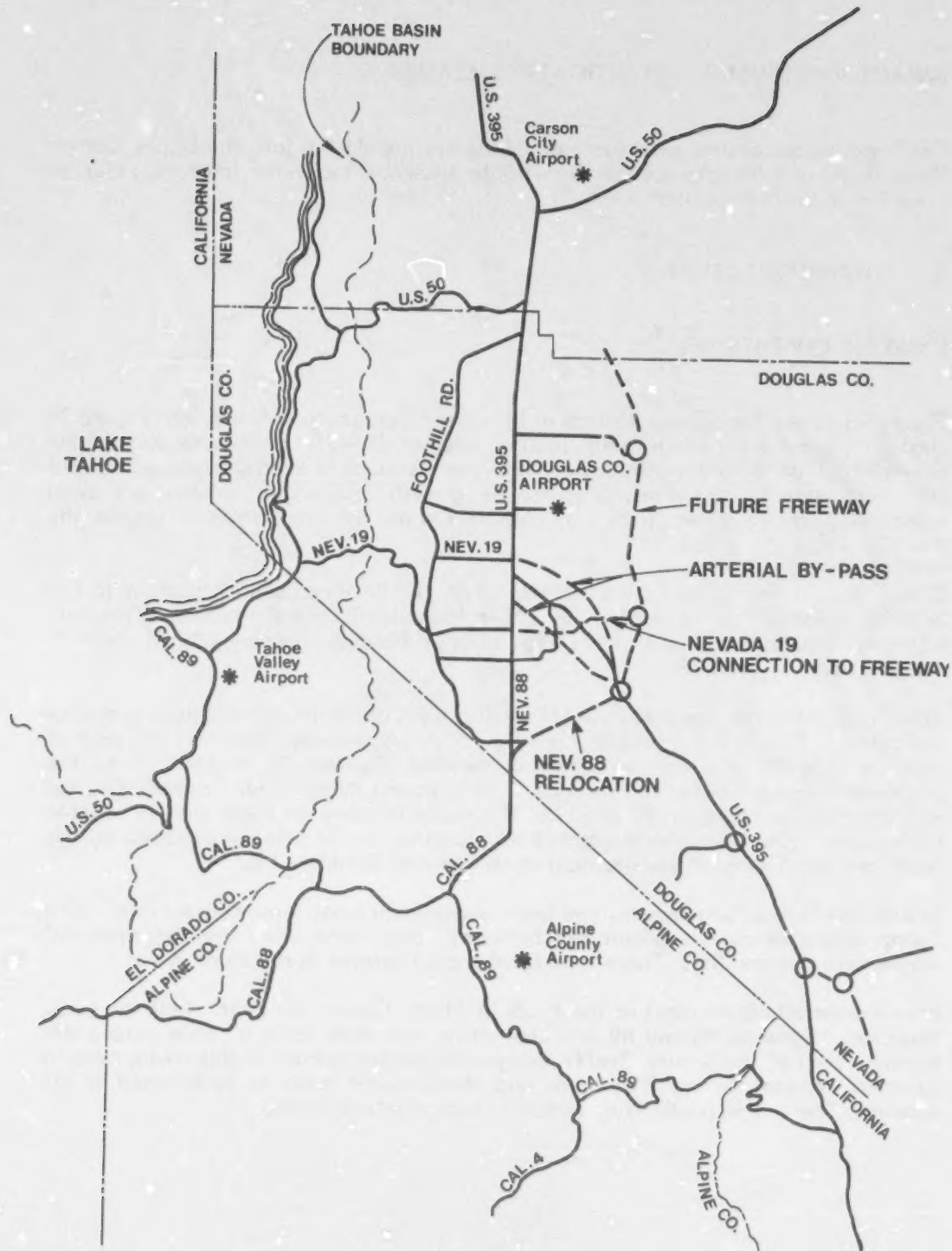


Figure 23
TRANSPORTATION FACILITIES
UPPER CARSON RIVER BASIN

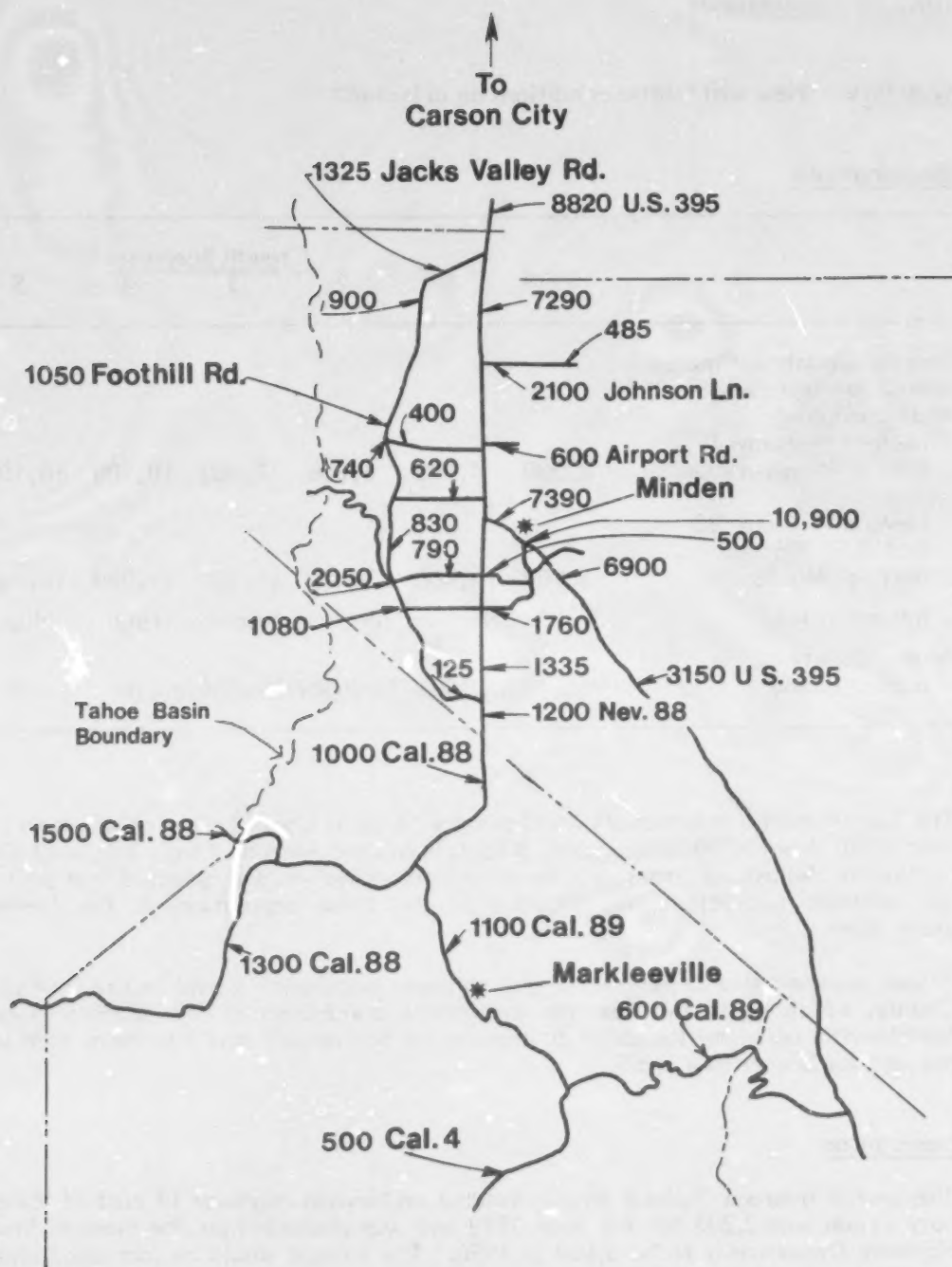


Figure 24
TRAFFIC VOLUMES
UPPER CARSON RIVER BASIN



IMPACT ASSESSMENT

Question: How will traffic conditions be affected?

Measurements

	1978	1	2	<u>Growth Scenarios</u>		5
				3	4	
Douglas County estimated annual average 24-hour traffic volume						
Nevada Highway 19 East of Kingsbury Grade	2,200	6,500	6,200	7,200	10,900	10,100
Nevada Highway 88 and U.S. 395 north of Minden	3,100	10,400	9,800	11,500	17,300	16,200
Impact rating		Medium	Medium	Medium	High	High
Alpine County Impact rating		Negligible	Negligible	Negligible	Low	Low

The future traffic volumes shown above for Douglas County were adjusted to the year 2000 from 1990 projections prepared by the Nevada State Highway Department. Adjustment factors were based on population and assumed that part of the spillover population was included in the total population of the Nevada projections.

It was assumed that 5 percent of the spillover population would locate in Alpine County, which could increase the permanent population of the Woodfords and Markleeville communities about 20 percent for Scenarios 1 and 2 to more than 100 percent for Scenarios 4 and 5.

Description

The annual average 24-hour traffic volume on Nevada Highway 19 east of Kingsbury Grade was 2,200 for the year 1978 and was projected by the Nevada State Highway Department to be 5,100 in 1990. The volume would be increased under conditions of spillover growth by the daily trips of casino-employed commuters.

On Highway 88 (and U.S. 395) north of Minden, the annual average 24-hour traffic volume was 3,100 in 1978 and is projected by the Nevada Highway Department to be 8,300 in the year 1990, when U.S. 395 is planned to bypass this section of road. The traffic volume on Highway 88 north of Minden is an indicator of the general level of traffic activity in the Minden and Gardnerville areas.

A



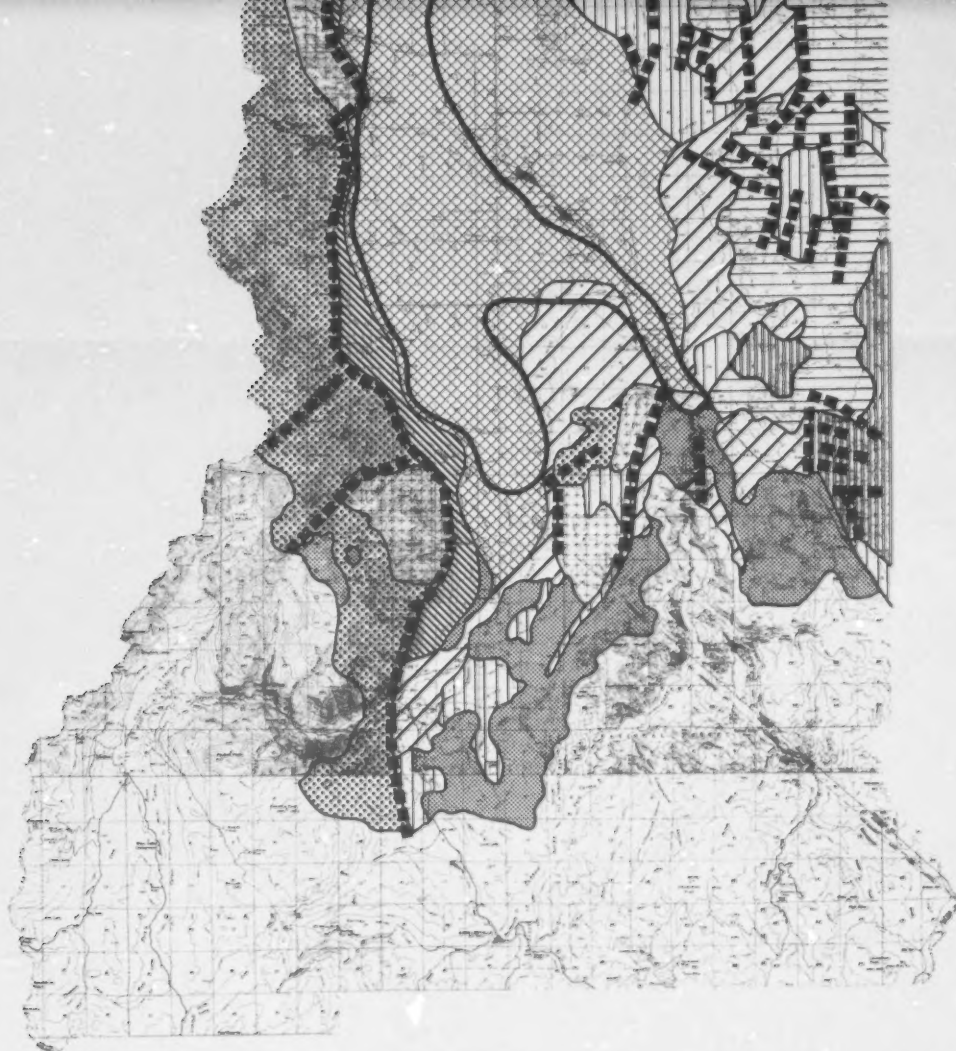


Figure 15 **GEOLOGIC UNITS
HAZARDS & FLOODING
UPPER CARSON RIVER BASIN**



APPROXIMATE 100 YEAR FLOOD PLAIN



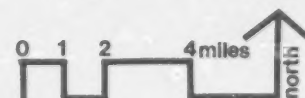
SEISMIC FAULTS

GEOLOGIC UNITS:

- RECENT FLOOD PLAIN ALLUVIUM
- TRIBUTARY STREAM DEPOSITS
- ALLUVIAL FAN DEPOSITS
- OLDER ALLUVIUM
- UNDIFFERENTIATED SEDIMENTS
- UNDIFFERENTIATED ANDESITICS VOLCANICS
- GRANITIC INTRUSIVES
- UNDIFFERENTIATED METASEDIMENTS
- UNDIFFERENTIATED METAVOLCANICS

Tahoe Region Environmental Evaluation Study

**U.S. Environmental Protection Agency
Sedway/Cooke**



B

A

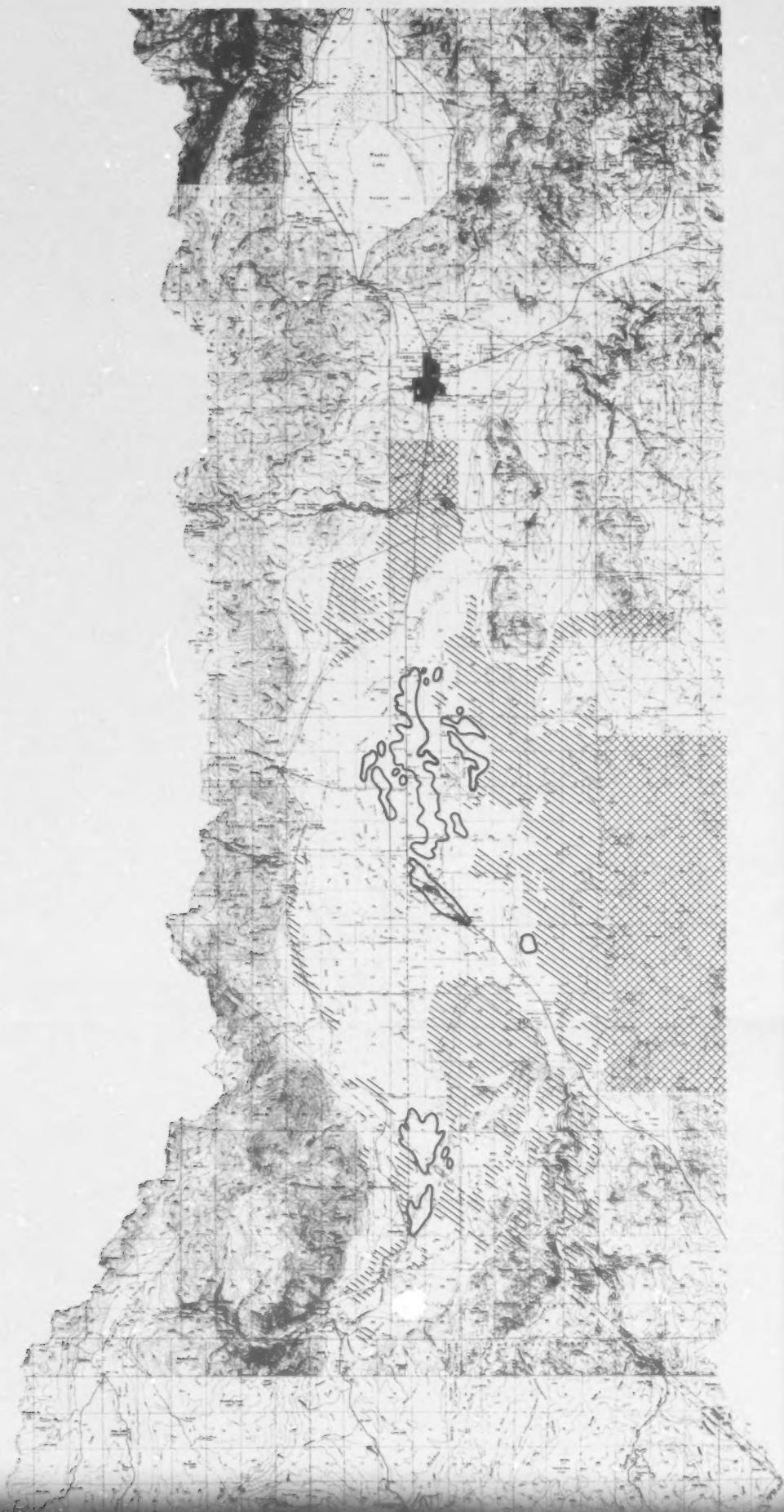


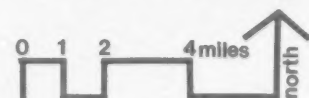


**Figure 16 SOIL SUITABILITY FOR
WASTEWATER IRRIGATION
UPPER CARSON RIVER BASIN**

-  **MOST SUITABLE**
-  **POTENTIALLY SUITABLE**
-  **MODERATELY SUITABLE**

Tahoe Region Environmental Evaluation Study

**U.S. Environmental Protection Agency
Sedway/Cooke**



B

Traffic on U.S. 395 (including the bypass segment) would increase independently of the population-generated traffic within the Minden and Gardnerville areas. The U.S. 395 traffic is projected to grow at a faster rate than the local traffic.

In Alpine County, the percentage increase in winter traffic would be high, but traffic conditions would be satisfactory. In peak summer days, the spillover population would add to the daily traffic volume by 1 percent for Scenarios 1 and 2, 2 percent for Scenario 3, 5 percent for Scenario 4, and 4 percent for Scenario 5. The capacity of the roads would be adequate for the increased volumes.

Critical Implications

Traffic volumes on Highway 19 would be heavier than appropriate for the width, grade, and alignment of the road, so that, in the future, either the roadway should be widened or traffic diverted to U.S. 50.

Spillover population would increase traffic volume in the Minden-Gardnerville areas, increasing traffic conflicts and congestion and probably requiring additional traffic controls.

MITIGATION MEASURES

1. Encourage car and van pooling to south shore casinos.

Description. Casino employees living in Carson Valley would drive to work in car pools or van pools to reduce cost of commuting and reduce traffic volume on Highway 19.

Effectiveness. Moderately to highly effective in reducing traffic volume on Highway 19 during peak commuter periods.

Responsibility. Casino management and employees.

Cost. Would reduce commuting costs. Casinos could encourage van pooling by assisting in financing of vans.

Timing. Could be implemented at any time.

2. Divert traffic from Highway 19 to U.S. 50 north.

Description. During periods of peak traffic and unsafe weather or roadway conditions, the road could be closed or could be left open to traffic in one direction only. Traffic in the other direction would be rerouted north to enter or leave the Lake Tahoe Basin on U.S. 50.

Effectiveness. Highly effective in controlling conditions on Highway 19.

Responsibility. Nevada State Highway Department and Caltrans.

Cost. Possible increase in state highway maintenance costs.

Timing. Could be implemented at any time.

3. Improve roads to accommodate traffic growth.

Description. Widening, new construction, and other improvements, as required, would provide traffic access and the capacity needed to accommodate traffic generated by growth of resident population.

Effectiveness. Highly effective in avoiding or reducing traffic congestion in residential and service areas of Carson Valley.

Responsibility. Nevada State Highway Department and Douglas County.

Cost. Would depend on location of development and capacity of each road to handle traffic increases, which would vary widely.

Timing. Individual road improvements should be coordinated with land development.

4. Establish local bus system connecting to south shore casinos.

Description. Local public transit services in Minden and Gardnerville areas and a connecting bus service to south shore casinos would be developed.

Effectiveness. Could offer highly effective service for commuters to south shore and would be moderately effective in reducing other traffic in the Minden and Gardnerville areas. Effectiveness would be limited by the low density of development, but effectiveness could be increased by land use controls to encourage location and type of development best suited to public transit service.

Responsibility. Douglas County.

Cost. Costs cannot be estimated accurately without designing the transit system in coordination with an established land development plan. However, the order of magnitude of the cost may be suggested by the costs of other comparable bus systems. The operating cost of the existing bus system in South Lake Tahoe was approximately \$600,000 in the fiscal year 1977-1978. Approximately \$200,000 was provided from the city's general fund.

The DeLeuw, Cather report of 1976 on a short-range transit plan for the Lake Tahoe Basin presented a five-year budget for expansion of north shore transit services, which included estimates of annual operating costs ranging from \$110,000 in 1977 to \$348,000 in 1981. The estimated capital costs ranged from \$233,000 in 1977 to \$87,000 in 1981. The portion of the cost remaining after deducting passenger revenues and federal and state aid was estimated at \$77,000 in 1977 and \$241,000 in 1981.

Timing. Development of the transit services should be coordinated with development growth in the Minden and Gardnerville areas. A specific plan and possible alternative plans for transit should be prepared in coordination with land development plans in order to encourage development favorable to transit service. The transit planning should be started well in advance of development approvals.

4. RECREATION

EXISTING CONDITIONS

Although adjacent to the Lake Tahoe Basin, the Upper Carson River Basin has not had the same recreational demand as its neighbor, and until recently, has not had to accommodate much overflow from the crowded Lake Tahoe area. Facilities in the Upper Carson River Basin are more limited than those in the Lake Tahoe Basin.

Federal Recreational Facilities

Toiyabe National Forest is administered by the Region V office of the U.S. Forest Service. The Forest Service operates one picnic area and five campgrounds in the study area. The Bureau of Land Management (BLM) operates the Indian Creek Recreation Area in Diamond Valley, California. Indian Creek Reservoir, the holding reservoir for Lake Tahoe's recycled wastewater, is open to boating, swimming, and fishing (the California Department of Fish and Game stocks the reservoir with 30,000 fish per year). The recreation area has camping sites for recreational vehicles and tents, picnicking areas, restroom facilities, a boat ramp, and hiking trails. The area is used fairly heavily, and in the early 1970s, before the above facilities were constructed, the reservoir was used by 1,000 anglers per weekend.

State Recreational Facilities

The state of California operates one recreational facility in the study area, Grovers Hot Springs State Park, and Nevada operates two, Mormon Station Historic Landmark and the Lake Tahoe Nevada Recreation Area. Nevada has recently acquired 2,616 acres at Washoe Lake, which, although outside of the study area itself, will provide some needed recreational facilities for Carson Valley residents.

Recreational Facilities Operated by Local Jurisdictions

Douglas County has expressed its intention of acquiring some BLM land for use as park (Douglas County General Plan, 1974). Alpine County provides the only county-owned recreational facility within the study area, Turtle Rock Park, on Highway 89 three miles north of Markleeville. The park has sites for recreational vehicles and tent camping, flush toilets, and fishing opportunities.

Private Recreation Use

The Minden-Gardnerville area is the center of commercial and residential development in the Carson Valley area of Douglas County and is a stopping place for through traffic on U.S. 395. This part of Douglas County does not attract many visitors. The private recreational establishments, such as the casino in Gardnerville, the golf course at Gardnerville Ranchos, and other amusements, are primarily frequented by residents. A medium-sized private campground for recreational vehicles near Topaz Lake and several motels in the Minden-Gardnerville area indicate that some, though not many, people visit the area.

Private recreational developments in Alpine County are limited to the Kirkwood Meadows ski area and a number of small motels in Kirkwood and Markleeville. Recreational use of public land and facilities in Alpine County is substantial when compared to use in the Carson Valley area of Douglas County, and private facilities have been developed to serve the needs of visitors rather than to attract them.

IMPACT ASSESSMENT

Question: How will the use of recreational facilities be affected?

Measurements

	<u>Growth Scenarios</u>				
	1	2	3	4	5
Availability of and accessibility of recreational facilities	Low	Low	Low	Low	Low

Description

Recreational supply in the Upper Carson River Basin far exceeds present demand. Although some areas such as Indian Creek Reservoir may become crowded, the overall effect of spillover growth from the Lake Tahoe Basin described in Scenarios 1 through 5 will not increase demand beyond total supply. If extreme pressure for development of the Carson Valley occurs from other areas such as Reno and Carson City, the available recreation supply may be inadequate.

MITIGATION MEASURES

As the impacts on existing recreational facilities due to increased spillover population are relatively insignificant, there are no adverse impacts and, hence, no discussion of mitigation measures.

5. PUBLIC SERVICES

EXISTING CONDITIONS

Health

The Carson-Tahoe Hospital is the only hospital in the Upper Carson River Basin. Its occupancy ratio (the number of in-patient days divided by the bed days available) has varied between 74 percent and 78 percent over the past five years,

which means that the hospital is operating very near its margin of safety. The hospital emergency room is overcrowded.

There are two private nursing homes in Carson City, which are usually full. Rehabilitation services are provided through public contract with private therapists. There are no health education services in either Minden-Gardnerville or Carson City. Prevention and detection services are provided by private physicians in Gardnerville and a public health nurse in Minden.

Alcoholism and drug abuse counseling services are provided by the Carson City Regional Council, and mental health counseling services are provided by rural clinics. There are no in-patient facilities.

The Alpine County Health Department contracts with the state of California for health services.

Schools

In 1977, the Douglas County School District had an enrollment of 2,031 students. The district is constructing two new elementary schools in the Carson Valley area and expanding Douglas High School. By 1981, the district will be able to accommodate 1,000 more students.

In Alpine County, spring 1978 elementary school enrollment was 134 students. Capacity in 1981 will be 230 students. Secondary students must travel to schools outside the county--most of them to Douglas High School in Nevada.

Fire Protection

The Insurance Services Office recommends that rural fire protection service maintain a rating of 8 or better on a scale of 1 to 10 (with 1 being the best service). Services of the major population center in Carson Valley are rated between 6 and 8. Sparsely populated areas of Carson Valley and Alpine County have marginal services rated at 9.

The U.S. Forest Service and the Nevada Division of Forestry have jurisdiction throughout the area to control forest and range fires.

Police Services

In Douglas County, the ratio of sworn personnel to residents is 3.1 per 1,000, substantially higher than the national average for rural areas of 2.1 per 1,000. In Alpine County, the ratio is 8.24 per 1,000--a misleadingly high figure; the Sheriff Department has seven sworn personnel, which is a minimum force to provide 24-hour service.

Solid Waste

Solid waste management in Carson Valley is provided by the counties, who contract with the South Tahoe Refuse Company through its subsidiary, the Douglas Disposal

Company. The townships of Minden and Gardnerville provide their own service.

Solid waste is delivered to the Gardnerville sanitary landfill, which is maintained by the South Tahoe Refuse Company.

IMPACT ASSESSMENT

Question: How will demand for and capacity of health care systems, schools, and law enforcement and fire protection services be affected?

Measurements

	1	2	<u>Growth Scenarios</u>		5
			3	4	
Spillover population (Percent increase of 1978 population)	33	27	55	164	146

Population growth affects demand for health care, schools, and law enforcement and fire protection services.

Estimates and ratings are for population spillover from the south shore, not total population, which would include spillover from the Carson City and Reno areas well as growth from local sources. Spillover from the Lake Tahoe Basin would contribute at most one-third of the total growth allowed under the 1975 Douglas County Master Plan.

Description

Health services that serve the Upper Carson River Basin are barely adequate or inadequate at the present time, and demand would increase under all scenarios. The addition of 33 beds at the Carson-Tahoe Hospital would relieve a shortage of acute-care beds, but emergency facilities would continue to be overcrowded. Except for rehabilitation services, which could accommodate a 10 to 15 percent increase, other services are also overcrowded. Mental health services and in-patient facilities for drug abuse and alcoholism are lacking, and need has been expressed for a clinic to treat minor illnesses and emergencies. Distance of services from the area mean that they are inaccessible to some users.

The number of school-age children would increase under all scenarios. Estimates based on the 1977 relationship of school enrollments to permanent residents in the valley portion of the Douglas County School District assume that school-age children would represent 20 percent of total permanent residents. This percentage may increase as the valley receives the spillover of families with school-age children who cannot afford the rising cost of housing in the Lake Tahoe Basin. Capacity estimates are based on a higher number of students per classroom than

currently recommended by school district policy. Under Scenarios 3, 4, and 5, the increase in the number of school-age children would exceed this capacity (approximately 1,000 additional students) as a result of spillover population from the south shore. Under Scenarios 4 and 5, the increase in school-age children would be roughly four times greater than the present capacity of the district's facilities.

Demand for law enforcement and fire protection services would increase under all scenarios, particularly Scenarios 4 and 5. Population growth would not account for all increases in service demand. Location and density of growth, the level of commercial and industrial development, and differences in service characteristics among land uses may also have an effect.

Critical Implications

Under Scenarios 3, 4, and 5, the already great discrepancy between supply and demand for health care systems would increase. Overcrowding would reduce the quality of care. Expansion of services would require increased state and federal funding, which is often unpredictable.

Under Scenarios 3, 4, and 5, where estimated school enrollment growth exceeds the capacity of existing and planned facilities, additional classrooms and staff would be required. Under Scenario 1, where estimated enrollment growth is slightly below capacity, present student-teacher ratios may actually increase. As the estimates do not take into account the distribution of students within the school district, the capacities of particular schools may be exceeded even though the enrollment growth estimated under a scenario is less than the districtwide capacity.

The increase in spillover population would probably contribute to the need for additional personnel and equipment for law enforcement and fire protection services if present levels of service are maintained. As growth changes the rural character of the valley to that of a more urban, bedroom community, there may be a demand for higher levels of service. Upgraded service standards would require more personnel and facilities. Maintaining adequate levels of fire service could also depend on extension of water supply to areas of future development.

Where facilities required to maintain existing quality of service are not provided, lower levels of law enforcement and fire protection services may result. More time may be required to respond to calls, the probability of structural and personal damage from fires may increase, and noncrime service calls may be assigned lower priorities for response.

If rising service demands are met by improved standards of service, higher service levels would benefit valley residents.

In the Carson Valley portion of Douglas County, fiscal resources are likely to be available to meet service demands. A substantial revenue base from gaming activities is available to the county, and as population growth and increased gaming activity occurs, this revenue base will increase.

In Alpine County, however, new development on any scale may require more fiscal resources than the present tax base can provide. Much of the responsibility for public service facilities could be shifted to the developer of new housing (and thus to the housing consumer). Requirements for service provision could affect housing prices and scale, type, and timing of development.

Question: How will solid waste collection and disposal systems in Upper Carson River Basin be affected?

Measurements

	<u>Growth Scenarios</u>				
	1	2	3	4	5
Volume of solid waste contributed by increased spillover population (cubic yards per year)	11,795	9,525	19,880	58,990	52,400
Percent increase over 1978 volume	36	29	60	179	159
Impact rating	Low	Low	Medium	High	High
Depletion of Gardnerville landfill (acres filled per year)	.3	.25	.5	1.5	1.35
Impact rating	Low	Low	Low	Low	Low

Volumes of solid waste generated by the spillover population are calculated by multiplying a per capita figure (based on collection records of the South Tahoe Refuse Company) by projected increases in spillover population. 1978 volume was calculated to be 32,915 cubic yards. An impact rating of low indicates the volume of solid waste could be handled by existing equipment and crews without adverse impacts. A rating of medium indicates that operations would have to be expanded to accommodate customers at the same level of service. A rating of high indicates that a major expansion of operations and costs would be required.

Acres of landfill depleted are based on the compacted volume of solid waste deposit, with adjustments for further compaction by machinery and the weight of other waste and for groundcover spread over the compacted waste.

Description

Rapid growth in the Upper Carson River Basin would require expansion of the solid waste collection and disposal services. Costs of expanding solid waste disposal services would depend upon where the spillover population settles. Many newcomers are expected to settle in the towns of Minden and Gardnerville (the Douglas County General Plan identified these areas as the future urban core of the valley). As the service population increases, to maintain once a week collections in these jurisdictions, additional trucks and labor will be required. Growth in outlying areas would be served by Douglas Disposal Company, which serves Alpine County and Douglas County outside of Minden and Gardnerville. Major service areas would be

Jacks Valley and Gardnerville Ranchos. Costs would include purchasing equipment, constructing facilities, hiring staff, administering a larger operation, and purchasing fuel for collection and disposal trips. No adverse impacts are anticipated in Alpine County.

Critical Implications

Under Scenarios 4 and 5, the scale of operations must expand appreciably to maintain the present level of service. Volumes are actually much greater, as the projected volumes do not take into account population growth for any other source but spillover.

MITIGATION MEASURES

Health

Most mitigation measures must be reviewed and approved by the Greater Nevada Health Systems Agency, which is responsible for evaluating the delivery and quality of health care in Douglas County.

1. Expand Carson-Tahoe Hospital.
2. Construct primary/intermediate care clinic.
3. Initiate and/or expand county health programs.
4. Encourage volunteer services.

Schools, Fire Protection, and Law Enforcement

5. Direct growth to areas with excess school capacity and where police and fire departments can take advantage of service delivery efficiencies resulting from increased population.
6. Institute double sessions or year-round school operations to reduce need for additional school facilities.
7. Coordinate land use planning and capital facilities planning and budgeting.
8. Adopt a system of regional tax-base sharing.
9. Use volunteer personnel for law enforcement and fire protection.
10. Require contributions from developers for capital facilities such as schools and fire stations.

Solid Waste

Mitigation measures should be consistent with the county solid waste plans. The operational plan for Douglas County is being formalized by the state Department of Environmental Protection. The Alpine County plan was approved in May 1977 and is enforced jointly by the Department of Public Works and a state health employee under contract to the Alpine County Health Department.

11. Expand present services by increasing equipment and labor to handle projected solid waste volumes.
12. Initiate public education and volunteer programs to reduce amount of solid waste generated, promote a clean, litter-free community, and achieve the state goal of a 25 percent reduction of waste going to the landfill.

6. UTILITIES

WATER

Water Supply

Water supply facilities in the Upper Carson River Basin include both municipal and agricultural systems. Most water demand is agricultural. Because of the relative shortage of water in the basin, state and federal involvement in water resources development has been extensive. Two projects of the U.S. Bureau of Reclamation are the Newlands Project and the Washoe Project. The California-Nevada Interstate Compact provides for water used by the Newlands Project. Under this project, the Lahontan Reservoir provides storage for inflow for the Carson River and diversions from the Truckee River. Releases from the reservoir are operated by the Truckee-Carson Irrigation District and used to irrigate 61,000 acres in the basin. From 1939 to 1970, federal agencies constructed the Boca, Prosser Creek, and Stampede reservoirs on tributaries to the Truckee River in order to supplement water supplies to the Newlands Project. Under operating policies, the Truckee-Carson Irrigation District is contracted to deliver 235,000 acre-feet of water from the Truckee River to the Lahontan Reservoir.

Under the Watasheamu Division of the Washoe Project, 32,000 acre-feet per year would be provided for irrigation, flood control, recreation, and municipal and industrial uses. A dam and reservoir situated on the East Fork Carson River would regulate high seasonal surface flows of the river. A gravity pipeline would deliver municipal and industrial supplies to Carson City from the reservoir. Water lost through evaporation and transpiration on 16,000 acres in the Carson Valley because of the high groundwater table would be recovered by a drainage system. Improvements in the lateral systems would provide a more efficient means of irrigation. Water development of the Watasheamu Division would not affect water levels in Pyramid Lake.

Water Use

Irrigation, net evaporation from free water surfaces, phreatophytes, and municipal uses have contributed to the depletion of the basin water supply. Because water supply is limited, competition among users occurs and when one user benefits, another suffers. For instance, urban growth would require more water than could be supplied without curtailing agricultural, fishery, and recreational uses. More water evaporates from the terminal lakes than can be replenished if irrigated agriculture and urban supplies are to be maintained.

Irrigation is the largest consumptive use of water in the valley. Some 240,000 acre-feet of water per year are diverted from the Carson River; 100,000 acre-feet are consumed by plant evapotranspiration and conveyance losses. The remaining 140,000 acre-feet are returned to the river as tailwater or agricultural return flow. The irrigation season extends from the first warm weather of spring (generally in March) until September and October.

Because of limitations on groundwater supply, the Nevada State Engineer has named the Carson Valley groundwater basin a "designated basin" under state law, allowing him to exercise greater authority over the appropriation of groundwater supplies. Individual wells on parcels at one acre or smaller are prohibited outright; all other applications are scrutinized for their potential impact on groundwater supplies; many are denied. Although present appropriations equal 39,000 acre-feet, the State Engineer estimates that the actual pumpage approaches 32,000 acre-feet per year. Not all appropriations are generally pumped or developed each year.

The availability of water supply in Carson Valley is further limited by the water rights of downstream users in Dayton and Eagle valleys. A surface flow of 286,000 acre-feet per year and a subsurface flow of 500 acre-feet per year from Carson Valley must be maintained to protect the water rights of downstream users.

Agriculture. Agriculture in the Carson Valley has been most intensive on the valley floor along the Carson River. Irrigation on the old farms of the valley floor is generally done by flooding, but some of the newer agricultural developments along the base of the Carson Range and the high east side of the valley use sprinkler irrigation. Data from the 1974 agricultural census indicate that 44,500 acres of land in the Carson Valley are being irrigated.

Seasonal and inefficient distribution of water has created problems for farmers. The lowest natural streamflow occurs during July and August, which are the months of greatest demand. As a result, groundwater pumping for irrigation is most extensive during these months.

Inefficient irrigation methods deplete the water supply and lower crop yields. Present irrigation methods do not meet the needs of plants and soils. The principal problems are:

- excessive seepage losses in porous ditch soils
- high sediment loads and aquatic growth, which reduce irrigation system capacities
- poorly constructed diversion structures that are easily damaged

- inadequate cropland drainage
- lack of vegetative maintenance, which causes consumptive water loss along ditches.

Municipal. Municipal water supply in the Upper Carson River Basin is primarily for domestic and commercial use. Few data are available on water use patterns and total consumption. As a result, the potential for water conservation is unknown. However, because of high agricultural demand, conservation in municipal systems would have a negligible effect on total water use. Although supplies are adequate at present, seasonal distribution affects water supply. Water shortages occur mostly during the summer when landscape watering increases.

Recently, the transfer or redistribution of existing water rights from agricultural to quasi-municipal use has increased substantially.

Wastewater Treatment

See discussion of "Existing Treatment Facilities" in "Wastewater Management Alternatives."

Energy

The Sierra Pacific Power Company supplies electricity to the Carson Valley through two substations in the Minden-Gardnerville area. The electricity is generated outside the area and transmitted in through a station near Carson City. Service to Alpine County is provided out of the Minden substation.

in the Upper Carson River Basin, the Southwest Gas Corporation supplies natural gas purchased from the Northwest Pipeline Company to some areas: Carson City, Minden-Gardnerville, Genoa and Jacks Valley.

To increase the capacity of its system, Southwest Gas is constructing a loop line that will parallel an existing line along U.S. 395. In addition, the company is seeking approval to construct a liquefied natural gas (LNG) storage facility east of Carson City.

Liquefied Petroleum Gas (primary propane) is supplied through local distributors operating out of Carson City and the Gardnerville area.

IMPACT ASSESSMENT

Question: To what extent will water supply be sufficient to meet demand?

Measurements

	1	2	<u>Growth Scenarios</u>		5
			3	4	
Available water supply	The available water supply currently equals demand or approximately 270,000 acre-feet per year. Depletion of the water supply will occur with any additional demand for water that does not involve water rights transfer or redistribution.				

Description

Surface water supply is irregular in Carson Valley. Water supplies are dependent on the winter snow pack in the Sierra Nevada, and streamflows are frequently low during midsummer and winter months. Agricultural irrigation, which accounts for almost all current water use, is supported by diversions from Carson River and is seriously affected during low streamflow months. Downstream and municipal uses exert other demands on the supply. Appropriations for surface water rights have been discontinued in Carson Valley because of limitations of the available supply.

Groundwater supplies are also limited. Available supply is 32,000 acre-feet; present appropriations equal 39,000 acre-feet. However, not all appropriations are pumped, and actual use more nearly equals the supply. A ban on extraction permits has been enacted by the Nevada State Engineer.

Although the unit water demand per acre is lower for urban areas than for agricultural areas (water needed for one acre of irrigated land could supply four single-family dwellings with 1,000 gallons per day) any additional demand would deplete the supply. As a result, Carson Valley could continue to accommodate urban growth only if agricultural activities decrease simultaneously.

Critical Implications

Water demand in Carson Valley will exceed supply with any increase of growth not involving a transfer of water rights or a reduction in agricultural demand. The impacts would be greatest under Scenarios 4 and 5. Growth not accompanied by the transfer of water rights would require a new source of water supply or measures which would free up available supply.

Question: What will be the effect of using STPUD secondary treated effluent for agricultural irrigation in Alpine County?

Measurements

	<u>Growth Scenarios</u>				
	1	2	3	4	5
Land required for effluent storage and disposal (acres)	1,900	2,540	2,200	1,900	2,540
Number of seepage control and monitoring wells for ground-water protection	7	10	9	7	10
Amount of diversion of West Fork Carson River to Indian Creek Reservoir (acre-feet per year)	815	815	815	815	815

Acreage requirements for effluent irrigation for Scenarios 1, 2, 4, and 5 were obtained from the facilities plan; the requirement for Scenario 3 was calculated from available data. To incorporate land use requirements for storage facilities, 10 percent was added to the irrigation acreage requirements.

Data on monitoring wells and diversions from West Fork Carson River were obtained from the facilities plan.

Description

The effects of using secondary effluent for agricultural irrigation in Alpine County would include changes in land use, reduced requirements for fresh water supplies, and, most significantly, possible impacts on groundwater quality.

The proposed plan includes maintaining Indian Creek Reservoir (ICR) as a recreational facility. Original estimates for use of ICR were 13,000 visitor-days per year; however, actual use has been over 66,000 visitor-days per year. Therefore, a major constraint on project implementation would be maintaining ICR. As the only major inflow to the reservoir is STPUD effluent, a new source would be required following conversion to secondary treatment. It is proposed that 815 acre-feet per year be diverted from West Fork Carson River to provide the water for ICR. This diversion would be similar for all five scenarios. Commitment of agricultural land for effluent disposal would be required and would preclude use of land for other purposes such as development.

The total cost of the land application system would be \$3.6 million for Scenario 3. The cost would be about 10 percent lower for Scenarios 1 and 4 and about 10 percent higher for Scenarios 2 and 5.

The cost of facilities for groundwater protection would be \$250,000 for each of the five scenarios. If the proposed seepage control wells are not effective in protecting groundwater, up to \$4.5 million in additional costs would be required to line the new storage reservoirs. Of the \$3.6 million for the land application system, \$1.5 million would be required for tailwater control facilities to prevent runoff to surface streams.

Critical Implications

When the original export project was conceived, Alpine County specified that it would only accept effluent from an advanced waste treatment plant. The new plan would reduce the quality of effluent to a secondary level. Therefore, it is still uncertain whether Alpine County will approve the current plan.

To maintain ICR under the plan recommended by STPUD, a supplemental water supply would be necessary. In the facilities plan, it was proposed that water be diverted from the Carson River for this purpose. This diversion would necessitate a transfer of water rights and substitution of reclaimed water for irrigation. The available land for irrigation in Diamond Valley may be limited to 3,000 acres, which would be adequate under all five scenarios.

Question: What will be the effect of the use of DCSID secondary treated effluent for agricultural irrigation in Carson Valley, Nevada?

Measurements

	<u>Growth Scenarios</u>				
	1	2	3	4	5
Land requirements for effluent storage and disposal (acres)	1,800	1,800	2,050	2,300	2,300

The estimated land requirements for effluent storage and disposal for Scenarios 1, 2, 4, and 5 were obtained from the facilities plan. The land requirement for Scenario 3 was calculated from available data.

Description

The effects of using secondary effluent for agricultural irrigation in Carson Valley, would include changes in land use from open range and dry farming, reduced requirements for fresh water supplies, and potential impacts on groundwater quality. A projected increase in water demand is one of the principal reasons for the proposed Watasheamu Project on the Carson River. If reclaimed water were used for agricultural irrigation, an additional 4,000 acre-feet per year of water would be available for use.

The estimated capital cost of the effluent disposal system for DCSID is \$19.7 million, which constitutes a major portion of the overall project. Of this total, only about \$150,000 is allocated for tailwater collection and return of runoff to surface streams. The proposed Watasheamu Project has an estimated cost of \$57 million, which could be reduced if treated effluent were used for agricultural irrigation.

Critical Implications

The critical implications of switching to land application are reduced streamflow in the East Fork and runoff from irrigated lands. By eliminating the present discharge at Muller Lane, DCSID will have reduced the annual average flow of the East Fork by 3 mgd which accounts for a large portion of the dry season flow. Consequently, the problems associated with diminished flow such as higher pollutant concentrations may occur more frequently. Furthermore, surface runoff from irrigated lands may be of a poorer quality than the effluent currently discharged to the river.

Question: How will demand for energy be affected?

Measurements

	Growth Scenarios				
	1	2	3	4	5
Increased demand for electricity impact rating	Low	Low	Low	Medium	Medium
Increased demand for natural gas (thousand cubic feet per day) Impact rating	1,620 Low	1,310 Low	2,730 Low	8,105 Medium	7,200 Medium
Increased demand for liquefied petroleum gas Impact rating	Low	Low	Low	Medium	Medium

Growth in electrical demand is assumed to be directly related to population growth. Impact ratings were determined by comparing increases in demand with the ability of the supplier to increase supplies. A similar procedure was followed to arrive at impact ratings for liquefied petroleum gas. Demand for natural gas was determined by multiplying projected spillover population increases by an average per capita consumption figure of 138 mcf per year.

Description

Adverse impacts of increased demand for electricity are minimal because additional capacity can easily be obtained as needed.

The demand for natural gas in the Carson Valley (including the Jacks Valley, Genoa, and Minden-Gardnerville areas) is well within the 16,700 mcf/d capacity of the pipeline serving the Carson Valley. Under Scenarios 4 and 5, where high spillover populations are projected, total demand for natural gas would approach 75 percent of system capacity. However, spillover population does not become significant until after 1990, by which time Southwest Gas will have had time to modify the supply system to meet any new or unexpected demands.

The supply of liquefied petroleum gas is readily available, and demand is not likely to increase appreciably because most spillover population will settle in the Minden-Gardnerville core, where electricity and natural gas are available. Accordingly, no serious impacts are anticipated.

MITIGATION MEASURES

Water Supply

1. Import reclaimed water for irrigation and irrigation return flows for reuse.

Description. Reclaimed water from both STPUD and DCSID treatment facilities could augment the irrigation water supply in the Carson Valley. Containment of irrigation return flows would prevent further degradation of water quality in the Carson River and increase water available for irrigation.

Effectiveness. Could be highly effective.

Responsibility. EPA, DCSID, STPUD, Nevada Department of Environmental Protection.

Cost. Undetermined. Could be cost effective solution to DCSID and STPUD disposal requirements and Carson Valley irrigation water requirements.

Wastewater Treatment

2. Monitor groundwater and irrigated runoff to ensure that land application of secondary effluent is not detrimental to surface and groundwater quality.

Description. The recommended facility plan provides for seepage control and monitoring wells to protect groundwater quality. If these measures are not successful, the lining of storage reservoirs should be implemented at a cost of \$4.5 million. To protect the quality of surface waters, runoff from irrigated lands could be collected and recycled.

Effectiveness. Highly effective if monitoring program is adequate.

Responsibility. In California, STPUD and RWQCB; in Nevada, DCSID and Environmental Protection Services.

Cost. Would depend on scope of monitoring program.

Timing. Continuous.

3. Maintain reliable treatment to ensure public health protection against potential hazards from using secondary effluent for irrigation.

Description. State and federal requirements dictate the level of operational personnel at the plant (grade V operator) to ensure high quality effluent at all times to protect public health. Storage reservoirs must be fenced to prevent public contact with the secondary effluent. Mixing facilities or operational modes for reservoirs should be provided to preclude odors.

Effectiveness. Would depend on efficient operation of facilities and maintenance of storage reservoirs.

Responsibility. In California, STPUD and RWQCB; in Nevada, DCSID and Environmental Protection Services.

Cost. See "Impact Assessment," above.

Timing. Continuous.Energy

Energy supplies should be adequate to meet demand, although should some additional electrical capacity be needed, Sierra Pacific Power Company could install additional transformers and regulators and modify Brunswick switching substation to provide distribution capabilities. Such modifications can be implemented quickly and are not contingent upon any permit approval. To ensure future supplies of energy, Sierra Pacific Power Company should continue to encourage energy audits, a service which is free to property owners. By documenting energy consumption habits and suggesting ways of conserving energy and redistributing energy demands more evenly throughout the day, Sierra Pacific Power Company can reduce peak loads on its system.

7. CULTURAL, ARCHAEOLOGICAL, AND HISTORICAL RESOURCES

The discussion of cultural, archaeological, and historical resources in the Upper Carson River Basin is included in the discussion for the Lake Tahoe Basin.

H. SUMMARY OF ENVIRONMENTAL EFFECTS

The primary focus of this EIS is to document effects that may result from improving and expanding the STPUD and DCSID wastewater treatment facilities. To assess these effects, existing, or baseline, conditions for both the natural and social environments are defined. The baseline conditions include the population and activities that contributed to peak 1978 wastewater flows of 5.8 mgd for STPUD and 2.3 mgd for DCSID.

Changes to these conditions are analyzed using five alternative growth scenarios that reflect different assumptions of casino development, housing demand, community service availability, and land use policies. For each scenario the capacity required to treat maximum daily wastewater flows is computed. These capacities range from 7.5 mgd to 10.0 mgd for STPUD and 3.1 mgd to 6.6 mgd for DCSID. Thus, EPA can associate the capacity requests by STPUD and DCSID with one of the alternative growth scenarios. For example, STPUD's preferred alternative includes expansion to a 10 mgd facility. A facility of that size is required to treat flows expected under either Scenario 2 or 5. Accordingly, the adverse secondary impacts of expanding to this capacity can be seen by reviewing the impacts described for either Scenario 2 or 5.

In order to focus attention on the critical issues, questions were posed to the general public at a series of workshops and to a committee of technical experts, the Technical Advisory Committee. The intent of the questions was to identify the level of environmental deterioration that could be tolerated and the kind of measures that would be accepted in order to minimize adverse effects. The level of detail in the impact assessment, which is particularly lengthy for water quality, land use, housing, and transportation, reflects the areas of concern expressed by the public and the advisory committee.

The unavoidable adverse impacts, tradeoffs between beneficial and adverse impacts, and commitments of resources specifically connected with the districts' preferred alternatives are detailed in the facilities plans and their companion environmental assessments. The growth-inducing effects, which are examined in this EIS, of implementing these projects are far-reaching in that they affect all aspects of the natural and social environments. Briefly, they relate to changes in the land use pattern and commitments of certain critical environmental resources to urban use; to greater demands on community facilities and services; and to changes to water, air and visual quality. It is important to note that these impacts are not evenly distributed among population groups--residents, vacant landowners, developers, casino owners, and visitors.

For example, an increase in the ambient noise level would annoy permanent residents and visitors to wilderness areas but would be of little consequence to owners of vacant land, developers, or visitors to the casinos. The biological community has also been identified as being particularly vulnerable to the effects of growth.

In the Lake Tahoe Basin, further urbanization would have unavoidable adverse impacts on water quality, high erosion hazard lands, SEZs, fish and wildlife habitats, air quality, visual quality, traffic circulation, quality of outdoor recreation experience and reliability of energy supply. In the Upper Carson River Basin, population "spilling out" of the Lake Tahoe Basin accounts for a relatively small proportion of total migration into the area. However, this amount of growth will cause overcrowding at public schools, change the rural setting to a more urban one, and place greater demands on already crowded health care facilities. The extent to which these impacts can be minimized depends on the commitments STPUD and DCSID can obtain from local, state, and federal agencies to implement remedial action.

Because the location of growth is addressed very generally, no attempt is made to quantify irreversible commitment of resources. The loss of high erosion hazard

lands and SEZs under each scenario, however, is expected and would commit these resources to an urban use. Development in SEZs is especially critical because it prevents their future use for wildlife habitats, aesthetic enjoyment, and runoff management and treatment. Scenarios that project higher growth levels result in substantial changes to existing land use patterns. Scenario 5 essentially fixes the land use pattern and precludes any flexibility to avoid conflicts between land use, environmental quality, and economic conditions.

The impacts on the natural and social environments are summarized in Table 41. The ratings should be interpreted loosely because they combine impacts occurring in STPUD and DCSID. For example, a highly adverse impact in STPUD may have been balanced with a negligible impact in DCSID to arrive at a summary rating of "adverse". Nevertheless, the ratings give an indication of the direction of the impact (beneficial versus adverse) and of the degree of impact among scenarios. The mitigation measures identified with each impact area are broad categories and encompass a variety of specific measures which are more fully outlined in the preceding sections.

TABLE 41
TREES IMPACTS SUMMARY

TREES IMPACTS SUMMARY						
GROWTH SCENARIOS						
SCENARIO 1						
SCENARIO 2						
SCENARIO 3						
SCENARIO 4						
SCENARIO 5						
POTENTIAL MITIGATION MEASURES						
IMPACTS						
LAKE TAHOE BASIN: NATURAL ENVIRONMENT						
High erosion hazard lands	-	-	-	-	-	Erosion control; land use controls
Stream environment zones	-	-	-	-	-	Land use controls
Pollutant loadings on lake	o	-	-	-	-	Land use controls; erosion controls
Lake eutrophication	o	-	-	-	-	Erosion control; land use control
Seismic risk	o	-	-	-	-	Building codes; land use controls
Rare and endangered species	o	-	o	-	-	Management; development controls
Ambient noise levels	o	-	-	-	-	Land use compatibility planning; performance standards
Air quality	o	-	-	-	-	Transit improvement; auto use controls; land use planning; stationary source controls
Visual quality	-	-	-	-	-	Land use controls; design review; TDR
LAKE TAHOE BASIN: SOCIAL ENVIRONMENT						
Changes in land use	-	-	-	-	-	Land use controls
Affordable housing availability	-	-	-	-	-	Federal programs; incentives; controls
Quality of housing stock	o	o	-	-	-	Housing codes; rehabilitation; incentives
Ability to develop subdivided lots	-	o	-	-	o	TDR; compensation
Traffic movement	-	-	-	-	-	Auto use controls; transit improvements
Quality of outdoor recreation experience	-	-	-	-	-	Management; public access
Delivery and quality of health care, schools, and police and fire protection	-	-	-	-	-	Facilities construction; health programs; consolidation; improved communication; reciprocal aid
Collection and disposal of solid waste	-	-	-	-	-	Expansion; education; recycling
Per-unit costs/revenues of public services	-	-	-	-	-	Trans. sharing; consolidation; facilities planning
Water supply	o	+	+	+	++	Conservation
Sewage capacity--STPUD	o	-	-	-	-	Grants; reuse; growth management
Sewage capacity--DCSID	o	o	-	-	-	Grants; reuse; growth management
Sewage treatment plant costs--STPUD	o	-	-	-	-	Grants; reuse; growth management
Sewage treatment plant costs--DCSID	o	-	-	-	-	Grants; reuse; growth management
Delivery and reliability of energy supply	-	-	-	-	-	Expansion; conservation
Historical/cultural resources preservation	-	-	-	-	-	Site analysis; dedication; restrictive easements
IMPACT RATINGS:						
+++	Extremely Beneficial	---	Extremely Adverse	o	Neutral/Negligible	
++	Highly Beneficial	--	Highly Adverse			
+	Beneficial	-	Adverse			

TABLE 41 (Continued)
TREES IMPACTS SUMMARY

TREES IMPACTS SUMMARY		GROWTH SCENARIOS					POTENTIAL MITIGATION MEASURES
IMPACTS	SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4	SCENARIO 5		
UPPER CARSON: NATURAL ENVIRONMENT							
Seismic risk	o	o	-	-	-	Building codes; land use controls Management; land use controls Land use controls; building codes Acoustical site planning N.A. Land use controls; design review; TDR	
Biological habitat preservation	o	o	o	o	-		
Flood hazards	o	-	-	-	-		
Ambient noise levels	o	o	o	-	-		
Air quality	o	o	o	o	o		
Visual quality	o	o	-	-	-		
UPPER CARSON: SOCIAL ENVIRONMENT							
Changes in land use	-	-	-	-	-	Land use controls Transit; roadway improvement N.A. Facilities construction; health programs; consolidation; improved equipment; mutual aid; growth management Expansion; education; recycling Conservation; reclamation Treatment; monitoring Treatment; monitoring Expansion; conservation Site analysis; dedication; restrictive easements	
Traffic movement	-	-	-	-	-		
Availability of recreational facilities	o	o	o	o	o		
Delivery and quality of health care schools, and police and fire protection	-	-	-	-	-		
Collection and disposal of solid waste	o	o	-	-	-		
Water supply	-	-	-	-	-		
Use of agricultural wastewater irrigation-Alpine County	o	-	o	o	-		
Use of agricultural wastewater irrigation-Carson Valley	o	o	o	-	-		
Delivery of energy supply	o	o	o	-	-		
Historical/cultural resources preservation	-	-	-	-	-		

IMPACT RATINGS:

- +++ Extremely Beneficial
- ++ Highly Beneficial
- + Beneficial
- Extremely Adverse
- Highly Adverse
- Adverse
- o Neutral/Negligible

IV. RECOMMENDED ALTERNATIVES

At this point, EPA has reviewed the studies that have been undertaken to resolve the problems confronting STPUD and DCSID. Based on this review, EPA recommends that the treatment process modifications preferred by each of the two districts be undertaken to improve the reliability of the systems and to meet federal and state water quality standards.

For STPUD, this means improving certain processes of the existing plant and abandoning most of the advanced wastewater treatment facilities. With respect to recommending a disposal method and location, the decision is less certain, because the site for disposal of effluent by land application is still being negotiated between STPUD, Alpine County, and Douglas County. STPUD, in its preferred alternative, proposes using treated effluent for agricultural irrigation in Alpine County, but the County has indicated reluctance to irrigate with secondary effluent. Consequently, STPUD is also considering Douglas County as a possible disposal site. Until the issue is resolved, EPA recommends land application of treated effluent as the preferred disposal method but must leave the specific site undesignated. Only after the district has negotiated a specific disposal site can EPA examine the environmental consequences and make its recommendation. Since Indian Creek Reservoir would no longer receive treated effluent under the preferred alternative, and the water level at this popular recreational site would have to be maintained, an exchange of existing water rights is recommended, as proposed in the facility plan. Farmers whose land would be irrigated with wastewater would permit Carson River water, the current supply for the farmers, to be used at Indian Creek Reservoir.

For DCSID, EPA's recommended alternative involves improving the existing secondary treatment plant, discontinuing discharge of effluent to the Carson River at Muller Bridge, using the treated wastewater for agricultural irrigation during the growing season, and storing the wastewater at other times. The effluent would be disposed on land owned by farmers and ranchers through long-term lease arrangements or on land controlled by the district. An agreement has already been reached between DCSID and a Carson Valley rancher to use all summer flows for irrigation. The feasibility of intensive land application during the winter is uncertain, and DCSID is proposing to explore this possibility. If DCSID determines that land application during the winter is feasible and wishes to pursue it, the district would have to modify its preferred alternative which presently recommends winter storage of effluent. EPA's final recommendation on effluent disposal, then would depend on the feasibility and environmental analyses of this revised preferred alternative.

STPUD is also seeking federal funds to expand its present treatment capacity to 10 million gallons per day (mgd). From EPA's perspective, funding a treatment plant of this capacity can be approved if there is no resulting environmental degradation of the region. A 10 mgd plant can accommodate the growth levels of Scenarios 2 and 5. Both of these scenarios caused serious environmental effects, particularly in the STPUD service area. It is STPUD's responsibility, then, to obtain commitments from various local, state, and federal agencies with authority to implement the

mitigation measures and to demonstrate to EPA that there will be no deterioration of environmental quality. Accordingly, the next step between now and preparation of the final EIS is for STPUD to seek commitments from implementing agencies. The result of this step will determine whether the project can be funded for 10 mgd as proposed by the district.

Similarly, DCSID, although not requesting an expansion of treatment plant capacity, will have to obtain commitments to implement mitigation measures. Indirect effects of primary concern include disruption of high erosion hazard lands, SEZs, and biological resources. If expansion of plant capacity is necessary because of development anticipated under the medium and high growth scenarios, the need to minimize adverse impacts becomes even more pressing in aspects of the social, as well as the natural, environment. EPA would be willing to fund expansion of treatment capacity if the resulting adverse secondary impacts could be adequately mitigated.

V. LIST of PREPARERS

A. SEDWAY/COOKE, Urban and Environmental Planners and Designers San Francisco, California

1. Responsibilities: prime contractor, project management, report preparation.
2. Personnel:

Paul H. Sedway, principal-in-charge
 Sheila Brady, project manager to January 15, 1979
 Walter Rask, project manager January 15 to September 1, 1979
 Rodney Jeung, project manager beginning September 1, 1979
 Charles Collins, associate planner
 Greg Sutter, planner
 Kathy Ottenberg, research assistant
 Sue Hyde, research assistant
 Mary Ann Tolmasoff, editing
 Barbara Lekisch, public participation
 Katherine Deal, graphics
 Lynda Wagstaff, graphics
 Grace Wright, typing

B. SRI INTERNATIONAL, Air Quality Consultants Menlo Park, California

1. Responsibilities: air quality analysis.
2. Personnel:

Dr. Walter Dabberdt, project manager
 Eugene Shelar, research meteorologist
 Christopher Maxwell, research meteorologist
 Ken Nitz, research meteorologist
 Larry Seiders, traffic consultant

C. RECHT-HAUSRATH & ASSOCIATES, Urban Economists San Mateo, California

1. Responsibilities: growth scenario development, economic and social analysis.
2. Personnel:

Linda Hausrath, project manager
 Jeff Oxley, research economist

D. JAMES M. MONTGOMERY, INC., Engineering Consultants
Walnut Creek, California

1. Responsibilities: facilities plans analysis, and water quality and resources analysis.

2. Personnel:

Robert Ellis, project manager
Annette Cormier, research assistant

E. ROBERT CONRADT, Transportation Consultant
San Rafael, California

1. Responsibilities: transportation analysis.

2. Personnel:

Robert Conradt, project manager

F. MADRONE ASSOCIATES, Biologists
Novato, California

1. Responsibilities: biological resources analysis

2. Personnel:

Diane Renshaw, project manager
Flip Dibner, research ecologist
Celia Lawren, research assistant

G. DAVID CHAVEZ, Archaeologist
Mill Valley, California

1. Responsibilities: cultural resources analysis.

2. Personnel:

David Chavez, project manager
Cindy desGrandchamps, research assistant

H. CHARLES M. SALTER ASSOCIATES, INC., Acoustical Engineers
San Francisco, California

1. Responsibilities: noise analysis.

2. Personnel:

Charles Salter, project manager

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VII. PERSONAL COMMUNICATION

Affidavits of B.E. Brockett, Joseph C. Easley, John J. Vostrez, in the U.S. District Court, Nevada; State of California vs. County of Douglas, motion for preliminary injunction on the Loop Road at State Line; May 1978.

Alpine County Sheriff Department

Ames, Laurel. California Tahoe Regional Planning Agency.

Antonucci, David. Lahontan Regional Water Quality Control Board.

Arnold, Gayle. U.S. Fish and Wildlife Service.

Badger, Rich. Golden Empire Health Systems Agency.

Baker, N. Caltrans, District 03, Marysville, California.

Barr, Don. Greater Nevada Health Systems Agency.

Barrett, Bobby. Gardnerville Garbage.

Beer, Jack. California Resources Agency, Department of Fish and Game.

Bendure, Ted. Nevada Department of Conservation and Natural Resources, State Conservation Commission.

Bissell, Germaine. Tahoe Regional Planning Agency.

Blume, Steve. Sierra Pacific Power Company.

Boand, Steve. California Tahoe Regional Planning Agency.

Bostrom, Kyle. Secretary, Kingsbury Fire District Board.

Cahill, Carl. Washoe County Health Department, Environmental Services Division.

Campbell, James. Consultant on Alpine County, California, General Plan, Noise element.

Canning, Gerald. Sierra Pacific Power Company.

Carson-Tahoe Hospital.

Christensen, Glenn. Nevada State, Department of Fish and Game.

Clauson, Larry. Douglas County Sheriff Department.

Cofer, James. South Tahoe Public Utilities District.

- Conradt, Robert. Transportation Consultant.
- Crow, John. Chief of Police, South Lake Tahoe.
- Culbert, Dav. Nevada Employment Security Division, Research Division.
- Davis, William. Lahontan Regional Water Quality Control Board.
- DeAmezaga, Evelyne. Tahoe Research Group, University of California, Davis.
- Ellis, Darwin. Fire Chief, Douglas County Fire Department.
- Farg, Frank. California State, Department of Fish and Game.
- Frantz, Ted. Nevada State, Department of Fish and Game.
- Goldman, Charles. Tahoe Research Group, University of California, Davis.
- Harjes, Gloria. Nevada Museum of Natural History.
- Herron, Gary. Nevada State, Department of Fish and Game.
- Hoefer, John. U.S. Forest Service.
- Holmes, Tom. Nevada State, Office of State Engineer, Carson City, Nevada.
- Hoose, Pete. Assitant Fire Chief, Tahoe Douglas Fire District.
- Hygren, Myrl. Health Planning and Human Resources, Nevada.
- Ingram, James. El Dorado County Planning Department.
- Jackson, George. Nevada State, Department of Energy.
- Jauregui, Miguel. Southwest Gas Corporation.
- Jeffress, Jim. Nevada State, Department of Fish and Game.
- Johnson, Warren. South Tahoe Refuse Company.
- Leonard, Robert. Tahoe Research Group, University of California, Davis.
- Leslie, Jene. Director, Tahoe Valley Airport.
- Livak, Joe. Health Planning and Human Resources, Nevada.
- Lockwood, Doug. California State, Solid Waste Management Board.
- Long, Bob. Nevada State, Division of Forestry.
- Martin, Jim. District Manager, Douglas County Sewer Improvement District No. 1.
- Martin, Richard L. Superintendent of Schools, Douglas County School District.

- McDowell, Robert. U.S. Forest Service, South Lake Tahoe.
- McDowell, Scott. Nevada Museum of Natural History.
- Milam, Ken. Director, El Dorado County Planning Department.
- Miller, Scott. Nevada Museum of Natural History.
- Morris, Frank. U.S. Environmental Protection Agency.
- Mross, George. Assistant Superintendent and Administrative Coordinator, Douglas County School District.
- Nevada Public Service Commission.
- Noble, Douglas. El Dorado County Planning Department.
- Oliver, William. California Public Utilities Commission.
- Orsak, Larry. Xerxes Society, Department of Entomology.
- Panik, Dr. Howard. Western Nevada Community College.
- Penzl, Anne. Nevada Museum of Natural History.
- Pike, Patty. Sierra Pacific Power Company.
- Pinzl, John. U.S. Bureau of Land Management, Carson City, Nevada.
- Randall, Brian. Office of the Nevada State Engineer, Division of Water Resources.
- Randolph, Stan. California Air Resources Board.
- Reed, Sherry. U.S. Forest Service, South Lake Tahoe.
- Rich, Charles. California State, Solid Waste Management Board.
- Ross, Vern. Nevada State, Division of Environmental Protection.
- Ryser, Fred. University of Nevada, Reno.
- Saake, Norman. Nevada State, Department of Fish and Game.
- Sanford, Fred. Supervising Sanitarian, El Dorado County Division of Environmental Health.
- Sawyer, Andrew. California State Water Resources Control Board.
- Scribner, James. Placer County Public Health Department.
- Smith, Doc. Douglas County Building Department.
- Smith, Fred. Nevada State, Department of Fish and Game.

Smith, Raymond. Consultant on Douglas County, Nevada General Plan.

Smith, Warren. El Dorado County Sheriff Department.

Stoms, David. U.S. Forest Service.

Stout, Paul. Southwest Gas Corporation.

Swing, Jack. California State, Department of Health, Office of Noise Control.

Thomason, William. Health Planning and Human Resources, Nevada.

Turnbeaugh, Leonard. Alpine County, Department of Public Works.

Vostrez, John. California Tahoe Regional Planning Agency.

Wagner, Richard. California State, Department of Fish and Game.

Weidmer, Curt. Director of Health Services, El Dorado County.

White, Charles. California State Water Resources Control Board.

Wickwire, Russell. California State, Department of Fish and Game.

Widby, Tad. California Tahoe Regional Planning Agency.

Williams, Jere. Creegan & D' Angelo, Consulting Engineers.

Willis, John. Petrolane.

Wright, Robert E. Deputy Attorney General, California.